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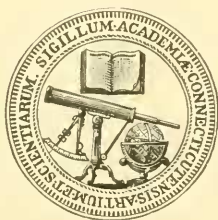
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Tertiary Spiders and Opilionids
of North America

BY

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TERTIARY SPIDERS AND OPILIONIDS OF NORTH AMERICA

INTRODUCTION

The present study is based on collections placed at the disposal of the author through the courtesy of the Museum of Comparative Zoology of Harvard University, of the U. S. National Museum, of the American Museum of Natural History, of Professor W. H. Twenhofel of the University of Kansas and of Professor T. D. A. Cockerell of the University of Colorado. To the above institutions and gentlemen the author expresses his deep appreciation of the privilege thus accorded him not only to reinvestigate the types previously described by Scudder, but to add several new species to those already known. The author is also deeply indebted to Professor Charles Schuchert who was instrumental in obtaining most of the material above mentioned. Although the study of the specimens was completed some time ago the work was considerably retarded at first by extraneous activities of the author during the war time and later by the difficulty of getting the proper help in making the drawings. All attempts to photograph the material proved highly unsatisfactory. Only a few specimens come out sufficiently well to allow of reproduction. The majority of the specimens are so faint and their colour so much like that of the surrounding rock that no combination of rayfilters, plates and illumination systems is of help in differentiating the specimens from the rock. At the same time the specimens are sufficiently well preserved to be clearly seen, measured and drawn. Thus drawings proved in every way much more satisfactory than photographs and were prepared by Miss F. E. Lovett, Mr. H. D. Rhynedance and myself. The pictures given by Scudder on Plate XI of his stately volume on Tertiary Insects of North America are so good that the expense of redrawing them would not have been justified and the reader is referred to Scudder's work.

The collections above mentioned contain altogether two distinct and hitherto unknown species of Opilionids and forty-seven distinct species of spiders representing seventy-six specimens or 89 pieces since several specimens consist of two pieces each. Six-

teen species of spiders are new to science and are described here for the first time. Besides the more or less complete specimens the Scudder collection of the Museum of Comparative Zoology contains also four impressions of single legs and eight cocoons. The latter were described by Scudder as belonging to a species which he named *Aranca columbiac*. I have not seen these specimens, nor do I include them in the present study because of the utter uncertainty of classification. That the specimens in question are spider-cocoons seems to be if not absolutely beyond doubt, at least highly probable. But even the family could not be identified with any degree of certainty, and the figures given by Scudder in his Tertiary Insects on Plate 2 make one believe that the cocoons in question are not all of the same species.

A few words of explanation are necessary concerning the recognition of species. Generally speaking it is much easier to recognize in a new palaeontological specimen a new species than to place it correctly in the system. Our knowledge of American Tertiary spiders was based on Scudder's work. A keen observer and a man broadly versed in the systematics of Arthropods, Scudder had no difficulties in assorting his material and describing the new species. He made minor mistakes, in a few cases he placed in the same species specimens distinctly belonging to different species, but the bulk of his species stand good to-day. At the same time Scudder has never been a professional arachnologist and the principles of classification gradually arrived at through the work of several distinguished European arachnologists remained unknown to him or did not appeal enough to him to be extended from the field of recent forms to that of extinct ones. Therein lies the weakness of Scudder's work. For although his species are good, the characters upon which their description is based, from the point of view of modern knowledge are entirely inadequate for the purpose of placing the species in the system. As will be pointed out further down, not only the generic characters, but even family characters as well as characters of entire sub-orders are usually so obliterated that Scudder had to rely mostly on external similarity. Naturally species of the same family have more resemblance to each other than to species of other families. External resemblance is the first principle in any assortment of large collections. At the same time, as is well known, it is one of

the most misleading methods imaginable. In spiders this is particularly true. We have parallel lines of development in Theraphosid and true spiders and among the latter in cribellate and ecribellate spiders. The similarity is so great that for years *Uloborus* and *Hyptiotes* of the Cribellates were placed among the orbweavers of the Ecribellates. The Agelenids have their counterpart in Diplurids among the Theraphosids. The similarity between our common *Agelena naevia* and *Evagrus mexicanus* of the Diplurinae is so striking that it extends over their behaviour and webconstruction, although *Evagrus* is more than twice the size of *Agelena* and on closer examination possesses all the distinctive characters of the group to which it belongs. Cases are known where external similarity has woefully misled the systematist. Thus a larva of a recent fly belonging to the genus *Microdon* has originally been described as a hard mollusk, and the cases constructed by some recent caddis-fly larvæ as shells. Misled by external similarity, the distinguished arachnologist Count Keyserling described a new genus of a cribellated spider, *Acanthoctenus* with two species as a new genus of the sub-order Citi-gradae, because he did not pay attention either to the spinnerets or the metatarsus of the fourth leg. The synonymy contained in arachnological works demonstrates clearly that similar mistakes have been made repeatedly by most eminent arachnologists. It only shows that errors are very easy to make and that in the absence of most important characters such errors are inevitable. Under the circumstances a modern arachnologist may well condemn any attempt at classification of extinct spiders. In recent spiders it is a comparatively easy matter to place a specimen in its proper family, it is more difficult to assign it to a genus, and it requires often minute study of characters invisible to the naked eye to determine the species. In this respect the study of extinct forms practically reverses the difficulty. With few specimens in existence it is a comparatively simple matter to establish the fact that a specimen under observation belongs to a different species from those already known; but with very few exceptions it is absolutely impossible to place it correctly in the system. What then should be done? Obviously the species should be carefully described and provisionally placed in such a genus and family with the recent representatives of which it has most resemblance.

When it comes however to a comparison between American and European spiders extreme caution is necessary. With families and genera uncertain, what reliance can be placed upon deductions made from such a comparison? Scudder may be pardoned for his attempt to do it, but no excuse would be valid in the case of a man thoroughly versed in the modern systematics of recent spiders. Faunistic and climatic conjectures are therefore entirely out of place.

Another side of the investigation was also sadly disappointing to the author, namely the complete absence of any structures which would allow one to unravel the mystery of the origin of the method of reproduction peculiar to spiders. In those cases where the male palpi are well preserved they show that at that geological period the copulatory apparatus was already fully developed and occupied the same position as in recent spiders. In one case the epigynum of a female is also surprisingly well preserved and quite of the type found in recent species.

THE RELATIONSHIPS OF ARACHNIDA.

It may be not quite out of place here to consider first of all the relationships of Arachnida and their place in the System of Arthropoda. Already in my monograph of Palaeozoic Arachnida I have pointed out the reasons why Pycnogonida, Tardigrada and Pentastomida (Linguatulida) have no place among the Arachnida. On the other hand I have included under Arachnida the Gigantostroma and the Xiphosura (Limuloids). I have also given a definition of the Class Arachnida in conformity with our knowledge at that time. Since then I have done some extensive study of segmentation in Arthropods, part of which studies is in press at this moment. The readers interested in the subject are referred to this paper which will appear in the Journal of Morphology. But the results of the investigation may be briefly summarized as follows: The Lankesterian division of the body of an Arachnid into a prosoma, mesosoma and metasoma of six segments each is entirely untenable and must be dropped. The Xiphosura have much in common with the Arachnida, but also possess many features which make their relationship with the Arachnida more than doubtful. Their arterial circulatory system is perineural. Their

carapace represents apparently not a fusion of the head with the thorax alone, but includes the first and second abdominal tergites. The segmentation of the scorpion shows the appearance of a spurious segment, but is in other respects similar to that of spiders. The carapace in all Arachnida represents the fusion of the tergites of the head and thorax, unless one or more of the thoracic somites are free, but it never includes any of the abdominal tergites. The arterial system is entirely independent of the nervous system and composed of supraneural, subneural and interneural arteries. Xiphosura cannot be regarded as ancestors of Arachnida for the same reasons. Very likely Xiphosura have Trilobites for ancestors as is also suggested by Raymond in his extensive monograph. The relationship of the Gigantostroma (Eurypterida) cannot be determined at present without further research. Provisionally at any rate they may be safely left with the Arachnida.

The new definition of the Class Arachnida may therefore be given in the following words. Arachnida are Arthropoda with heteromeric segmentation. Their body is composed of 21 somites four of which are prae-oral in the adult, the fourth somite bearing the chelicera. The first postoral somite belongs to the head and bears the pedipalpi. The thorax consists of four somites each provided with a pair of appendages, with the exception of some Acari in which only the first and second thoracic somites bear appendages. Head and thorax are usually fused into a cephalothorax, but in some Orders one, two or even three of the thoracic somites may remain free. The abdomen is composed of 12 somites, the first of which is rudimentary in the adult, being represented only by its neuromere, except in the Pedipalpi in which it persists throughout life. Further fusion of somites involves the posterior end of the abdomen, beginning with the last somite and proceeding forward. Secondary spurious segmentation in the abdomen, as in the case of the 18th somite of the scorpion, may result in the formation of an additional segment which does not possess the value of a somite. The anus is always on the last somite. The genital opening is on the eleventh (second abdominal) somite. Nephridia modified as coxal glands situated in the thorax. Respiration by means of lung-books or tracheæ, in some forms organs of respiration entirely absent. Circulatory system with a heart in which the cardio-aortic valve always marks the

limit between the last thoracic and first abdominal somite (i. e. between the 9th and 10th somites). The reduction of the heart always begins at the posterior end and proceeds forward. The arterial system wherever fully developed consists of an aorta with its arch and pedal arteries and a series of interneural arteries connecting the supraneural with the subneural artery. The legs are typically of 7 joints the last of which in some cases may be sub-articulated; the pedipalpi of 6 joints, the terminal joint corresponding to the last two joints of the legs. The chelicerae are 2 or 3 jointed. The eyes whenever present are always simple, not more than 12 in number and belong to the first and second somites. External segmentation of the adult does not coincide with true segmentation.

To facilitate the understanding of the above definition the following table comparing apparent segmentation in several Orders of Arachnida with true segmentation may not be without practical value to students of extinct Arthropoda.

The Table needs little explanation. The transverse lines indicate the limits between segments as they actually appear to the eye, not as derived from the presence of appendages or from the study of internal anatomy and embryology. The somitic value of the sternum in the cephalothorax is omitted in all cases in order to emphasize the differences in the composition of the carapace as well as for lack of space. Attention is called to the fact that the normal or most primitive type of segmentation is found not in Scorpions but in Pedipalpi. There is still some difference of opinion concerning the eyes in Araneae. Schimkewitsch and Scheuring homologize the indirect eyes of spiders with the median eyes of scorpions, and the direct eyes with the lateral eyes of scorpions. Schimkewitsch even gives a figure of the ganglia as derived from the study of sections in embryos of *Ischnocolus*. It seems to me however that the evidence adduced by the above mentioned investigators is not sufficient to decide the case in their favor and I retain for the present the homology of the median eyes of the scorpion with the direct eyes of spiders.

It is not impossible that Arachnida possessed originally a few somites *in front* of the eyes. Corresponding neuromeres have been figured by Schimkewitsch. If such is the case the body of an Arachnid is in reality composed of more than 21 somites, but

SOMITES		SCORPIONES	PEDIPALPI	SOLIFUGAE	OPILIONES	ARANEAE	LIMULUS
CEPHALON	1 (1 C)	MEDIAN EYES	MEDIAN EYES	MEDIAN EYES	EYES	DIRECT EYES	MEDIAN EYES
	2 (2 C)	LATERAL EYES	LATERAL EYES	LATERAL EYES	?	INDIRECT EYES	LATERAL EYES
	3 (3 C)	ROSTRUM	ROSTRUM	ROSTRUM	ROSTRUM	ROSTRUM	? ROSTRUM
	4 (4 C)	CHELICERAE	CHELICERAE	CHELICERAE	CHELICERAE	CHELICERAE	CHELICERAE
	5 (5 C)	PEDIPALPI	PEDIPALPI	PEDIPALPI	PEDIPALPI	PEDIPALPI	PEDIPALPI
THORAX	6 (1 TH)	1 pair of LEGS	1 pair of LEGS	1 pair of LEGS	1 pair of LEGS	1 pair of LEGS	1 pair of LEGS
	7 (2 TH)	2 pair of LEGS	2 pair of LEGS	2 TERG. = 2 p. LEGS = 1 stig.	2 pair of LEGS	2 pair of LEGS	2 pair of LEGS
	8 (3 TH)	3 pair of LEGS	3 pair of LEGS	3 TERG. = 3 p. of LEGS	3 pair of LEGS	3 pair of LEGS	3 pair of LEGS
	9 (4 TH)	4 pair of LEGS	4 pair of LEGS	4 TERG. = 4 p. of LEGS	4 pair of LEGS	4 pair of LEGS	4 pair of LEGS
ABDOMEN	10 (1 A)	(First abdominal neuromere)	1 TERGITE = STERNITE	?	?	PETIOLUS	CHILARIA
	11 (2 A)	1 TERGITE = GENITAL OPERC.	2 TERG. = GEN. OP., 1 LUNG	1 Segment = GENITAL OPERC.	GEN. Arches = GENIT. OPERC.	GENITAL OPENING = 1 LUNGS	GENITAL OPERCULA
	12 (3 A)	2 TERGITE = COMBS	3 TERGITE = STERN., 2 LUNG	2 SEGMENT = 2 STIGMA	STIGMA	2 LUNGS or SPIRACLE	1 GILL-BOOKS
	13 (4 A)	3 TERGITE = 1 LUNGS	4 TERGITE = STERNITE	3 SEGMENT = 3 STIGMA	1 SEGMENT	CRIBELLUM and ANT. SPINNER.	2 GILL-BOOKS
	14 (5 A)	4 TERGITE = 2 LUNGS	5 TERGITE = STERNITE	4 SEGMENT = MEDIAN STIG.	2 SEGMENT	MED. and POST. SPINNERETS	3 GILL-BOOKS
	15 (6 A)	5 TERGITE = 3 LUNGS	6 TERGITE = STERNITE	5 SEGMENT	3 SEGMENT	ANAL TUBERCLE	4 GILL-BOOKS
	16 (7 A)	6 TERGITE = 4 LUNGS	7 TERGITE = STERNITE	6 SEGMENT	4 SEGMENT		5 GILL-BOOKS
	17 (8 A)	7 TERGITE = STERNITE	8 TERGITE = STERNITE	7 SEGMENT	5 SEGMENT		6 ABDOMINAL SPINE
	18 (9 A)	1 CAUDAL SEGMENT	9 TERGITE = STERNITE	8 SEGMENT	6 SEGMENT		2 postbranchial neurom.
	19 (10 A)	2 CAUDAL SEGMENT	1 CAUDAL SEGMENT	9 SEGMENT	7 SEGMENT		3 postbranchial neurom.
	20 (11 A)	3 CAUDAL SEGMENT	2 CAUDAL SEGMENT	10 SEGMENT	OPERCULUM ANALE		
21 (12 A)	4 CAUDAL SEGMENT	3 CAUDAL SEGMENT					

Date	Description	Amount
1890	Jan 1	100.00
	Feb 1	200.00
	Mar 1	300.00
	Apr 1	400.00
	May 1	500.00
	Jun 1	600.00
	Jul 1	700.00
	Aug 1	800.00
	Sep 1	900.00
	Oct 1	1000.00
	Nov 1	1100.00
	Dec 1	1200.00
	Total	10000.00

in absence of definite data it seems wiser to limit the discussion of homologies to somites the presence of which can be always demonstrated. The same holds true of Xiphosura.

CLASSIFICATION IN ARANEÆ.

Let us now proceed in detail with the discussion of the problem of classification in spiders and especially with that of identification of extinct species. Lest much of what I have said may seem to be unsupported by facts, arbitrary and attributable rather to personal shortcomings of the author than to poor preservation of the material itself, I shall give two examples and submit these to an exhaustive analysis so that the reader may form a judgment for himself. The spiders which I choose for this purpose, *Parattus resurrectus* and *Titanocca ingenua*, are fairly well preserved. Both belong to the sub-order of Arachnomorphæ or True Spiders, characterized by the direction of the axis of articulation of the chelicerae, the presence of well developed maxillary lobes and the possession of a single pair of lungs and of a single (or of a pair) tracheal spiracle. Neither of these characters can be determined from an examination of the specimens in question, but the combination of other characters, the general appearance, the size, the proportion of the legs, the "tout ensemble" so to say, makes a mistake impossible. So far, so good.

The first sub-division of True Spiders is based on the presence or absence of a cribellum in front of the spinnerets and of a calamistrum on the fourth metatarsus. The Family Attidæ, to which according to Scudder who established the genus *Parattus* for three species of Tertiary Spiders that genus belongs, comes under the division Ecribellatæ. The absence of a cribellum and calamistrum in recent spiders may be ascertained without difficulty, but only with the aid of a lens. Moreover, the calamistrum can be seen only in a certain position of the leg. How much of these structures may have been preserved in extinct spiders? Spines and hair are well preserved in some specimens. Spinnerets, as a rule, are not nearly as well preserved. In *Parattus resurrectus* one can see with the aid of a good binocular dissecting microscope at a magnification of about 60 diameters simple brown hair on the spinnerets and similar hair and spines on all legs. No cribellum and no calamistrum are visible. In absence of traces of these

structures we may reasonably assume that *Parattus* did not possess them, but the absence of a character is in itself not a sufficient proof, because in no case are all structures preserved.

Assuming then that *Parattus* actually did not possess these structures we may place it in the division Ecribellate. This division is composed of 28 families in recent spiders. What are the distinctive characters of the Family Attidæ? 1) Presence of a *single* spiracle immediately in front of the spinnerets; 2) Two tarsal claws and unguis tufts; 3) Eight eyes in three or four rows, anterior median eyes by far the largest, eyes of second row minute; 4) All eyes of the diurnal type; 5) Clypeus vertical; 6) Absence of colulus; 7) Body often covered with scales. Of these characters the relative size and position of the eyes is the most conspicuous and usually allows at once to recognize an Attid in a recent spider. How about *Parattus*? The eyes of the second row are not discernible in any of the three species. Scudder describes for *Parattus resurrectus* the "eyes of the second row from one-eighth to one-tenth the size of those of the first row, situated behind and within the middle anterior pair, so that lines drawn through the middle of the large and small ones would meet in a right angle behind the small ones and leave them distant from each other by about their own diameter; the outer edge of either of the small ones is behind the inner edge of one of the large ones" (p. 54). No similar position of the eyes of the second row is known to occur in any of the hundreds of recent Attidæ. If the little impressions which Scudder described as eyes of the second row actually represent eyes then *Parattus* is not an Attid at all. Similarly, if the anterior median eyes are equal in size to or scarcely larger than the anterior lateral eyes, then, as Scudder himself points out in his definition of the genus *Parattus*, this character separates *Parattus* "from all members of the Family." But the eyes of the third row being "not discernible" in *Parattus resurrectus*, "doubtful" in *Parattus latitatus* and preserved only in the otherwise poorly preserved specimen of *Parattus evocatus*, in which the eyes of the second row according to Scudder himself are "indiscernible," what value can be placed in the generic character when the corresponding family character is not in evidence?

Of the other six characters of the Family Attidæ enumerated

above, characters the combination of which might have come to our help, not a single one can be recognized. Even in recent spiders the spiracle can be seen only with difficulty, the diurnal type of eyes is an expression of the internal structure and cannot be preserved, the clypeus, if properly preserved would appear only in a plane vertical to the surface of the specimen and the absence of the colulus is only a negative character. The claws could be seen under microscope if they were preserved, but although every spider has either two or three claws on each tarsus, none of the specimens in question show any trace of them. Similarly, although the specimens show well preserved hair and spines, there is no trace of scales. The evidence, such as there is, points therefore *against* the probability of *Parattus* belonging to the Family Attidæ.

But let us assume for the moment that *Parattus* is an Attid. The separation of Attidæ into genera is based on the following characters:—1) Number and structure of teeth on the lower margin of chelicerae; 2) Size and shape of the entire eyegroup; 3) Relative position of the eyes of the second row; 4) Number of spines on the underside of the first tibia; 5) Number and distribution of other spines on legs; 6) Distance between the anterior coxæ; 7) Shape and especially elevation of carapace; 8) Shape of underlip; and 9) Shape of sternum. Most of these structures are either poorly preserved or entirely indiscernible. If the family relationship were definite then indeed the genus would be sufficiently characterized by the proportion of the anterior eyes and we could disregard the other characters. As for the specific differences given by Scudder for his three species of *Parattus* and consisting in the shape and proportions of the cephalothorax, these differences in recent spiders would undoubtedly have generic and not specific value. For the recognition of species in Attidæ is based chiefly on the structure of the male palpus and female epigynum, the distribution of color on the abdomen, carapace and legs, the type of hair and scales, modification of the legs, etc.

The case of *Titanocca ingenua* (as well as that of *Titanocca hesternna*) is still worse. The genus *Titanocca* has been established by Thorell for spiders which belong to the division Cribellatæ. Scudder mentions the fact that this genus "is not far removed from *Amaurobius*," but in his description of both species

he fails to mention altogether either the calamistrum or the cribellum. In fact he does not mention even the spinnerets. Yet the spinnerets are visible in *Titanocca ingenua* which is by far the better preserved species. The spinnerets are far apart, reminding of recent Drassids. No cribellum is visible. The legs are extraordinarily well preserved and the fourth metatarsi do not show anything like a calamistrum. It is therefore not probable that the spider in question is either a *Titanocca* or any other cribellate species. But while the exclusion of this species from the division of Cribellatae is a comparatively simple matter, it is almost impossible to establish its true relationships. On account of its general appearance and the structure of the spinnerets I have placed both species provisionally under the family Drassidæ.

Of the forty-seven species of spiders presented in this paper, *Nephila pennatipes* and *Tetragnatha tertiaria* are the only ones whose generic identity seems to be sufficiently well established. The three species of *Thomisus* undoubtedly belong to the family Thomisidæ, but the genus in its modern conception remains uncertain. The same may be said about the species referred to the genus *Epeira* of the family Argiopidæ (Epeiridæ). The genera *Tethincus*, *Parattus* and several new genera proposed by me all deal with extinct forms and have therefore a different value from genera of recent spiders. None of the remaining spiders can be placed in the system satisfactorily. In these cases I did not feel justified to establish new generic names, a procedure which is advisable only where it is sure that the species does not belong to the genus under which it was originally placed. Each case will be discussed separately. In each such instance the genus used by modern arachnologists for recent species may have only the value of a vague approximation.

ORDER ARANEÆ.

Spiders represent a very natural order and already in the Upper Carboniferous or Pennsylvanian Period are easily distinguishable from all other Arachnida. In all recent spiders with the exception of the family Liphistiidæ of the sub-order Mesothelæ and in all Tertiary spiders known the abdomen appears unsegmented. In all spiders without a single exception the abdomen is joined to the cephalothorax by means of a very thin petiolus representing

the first abdominal somite. There is therefore a deep constriction between the carapace and the abdomen, whereas in Opiliones and Acari no constriction is noticeable because the abdomen is broadly joined to the cephalothorax. In Ricinulei the abdomen is also provided with a petiolus, but the coupling of the abdomen with the carapace is such that it has all appearance of a broadly joined abdomen. Moreover the Ricinulei possess a cucullus in front of the carapace. The Solifugæ have certain similarity with spiders although their abdomen is broadly joined to the carapace. What permits an easy separation of the Solifugæ from the spiders is the difference in the structure of their carapace and chelicerae. The carapace in Solifugæ represents the fusion of the cephalic tergites with the first thoracic tergite, leaving the second, third and fourth thoracic tergites free, whereas in spiders all thoracic tergites are fused with the cephalic tergites. The chelicerae of spiders are retrovert, those of Solifugæ chelate. From other orders of Arachnida in which the abdomen is also joined to the carapace by means of a petiolus the spiders can be distinguished by their chelicerae and pedipalpi. In recent forms confusion is impossible. In extinct forms members of the sub-order Amblypygi of the order Pedipalpi could be easily confused with spiders if the preservation were deficient. In such cases the relative size and position of the coxæ comes to our aid. The possession of spinnerets on the abdomen is an exclusive characteristic of spiders, and if spinnerets are preserved spiders can be recognized as such even if all other characters are indistinguishable or missing.

Tertiary spiders possess already all the characters of recent spiders, including the epigynum in females and the copulatory apparatus on the terminal joint of the palpus in the male. The external appearance of Tertiary spiders is much the same as in common spiders of the present time and their habits, in a general way, must have been similar. It is difficult to say whether the paucity of material is attributable to the poor conditions prevailing in the Tertiary for the preservation of spiders, or to the relative paucity of the spider fauna itself of that period. For the recent spider fauna runs into several hundred as against the forty-seven Tertiary spiders of the same geographical region. Considering the numerous species preserved in the European amber we may reasonably assume that the real number of American Tertiary spiders must have been considerable.

SUB-ORDER MYGALOMORPHILÆ.

Spiders with an unsegmented abdomen and two pairs of lungs. Articulation of chelicerae such that the fangs move in a plane parallel to the plane of symmetry.

This sub-order comprises two families, Aviculariidae and Atypidae.

FAMILY AVICULARIIDÆ.

Usually four, sometimes two spinnerets. (Anterior spinnerets belonging to the fourth abdominal somite and found in Atypidae and other spiders are missing in Aviculariidae.) Eyes eight or six, usually situated on an elevation and forming a compact group. Anterior median eyes alone of the diurnal type. Coxæ of pedipalps without maxillary lobes.

A very large family comprising almost all recent Theraphosid spiders and practically limited to the equatorial and tropical belts. In this country the family is represented by some thirty species, most of which are distributed through the southern states and California. One species was found in Virginia, another in the Indian Territory. I have a single specimen of a species new to science and as yet unpublished from Indiana.

The separation into sub-families and genera of spiders belonging to the family Aviculariidae is based on the following characters: structure of the tarsi and number of claws, number and structure of spinnerets, presence or absence of a rastellum on the chelicerae, number of eyes and configuration of eyegroup, shape of carapace and sternum.

Being unable to place the single species of Theraphosid spider from Florissant under any of the numerous recent genera, I propose the new genus *Eodiplurina* for Tertiary forms more or less related to the recent sub-family Diplurinae.

Genus *Eodiplurina*, new.

Theraphosid spiders with two pectinated claws and two pairs of spinnerets of which the posterior pair is three jointed and much longer than the anterior pair. Genotype: *E. cockerelli*.

Eodiplurina cockerelli n. sp. (Text figures 1 and 2).

A very well preserved specimen of a female, on both pieces showing only the ventral surface. Total length including chelicerae 15 mm. Abdomen 7 mm. long. Outline of carapace not visible.



FIGURE 1.—*Eodiplurina cockerelli* n. sp. x 13.

Chelicerae heavy, their inner margin with a row of dark, distinct granules and a thick scopula. The fangs are not well preserved. Coxa of pedipalps without maxillary lobe. Lip about as long as wide. Sternum almost circular. Anterior coxae widely

separate, posterior ones contiguous. Abdomen oval, lighter in color, sparsely covered with thick, simple hair, with a darker spot in the middle of the genital area. On one side of the dark spot two faint impressions, one behind the other, possibly imprints of the lung-books. The spinnerets are well preserved, covered with simple hair, spinning tubes not discernible. First pair of spinnerets small and far apart. Second pair large, three-jointed, at least three times as long and considerably stouter than anterior spinnerets. Pedipalps with a pectinate claw. Legs and pedipalps covered with simple, thick hair and scattered spines which are rather weak. Tarsal joints of legs apparently without scopula, with a pair of pectinate claws. The claws of the third right



FIGURE 2.—*Eodiplurina cockerelli* n. sp. A claw of the third left foot. x 135.

tarsus (in the specimen on the left side) are especially well preserved. Its structure is shown in *textfigure 2* drawn with the aid of an Abbe drawing apparatus at a magnification of 135 diameters. The claws are with a series of from 8 to 9 teeth increasing in size from the base of the claw distally. Legs: 4123.

MEASUREMENTS OF THE LEGS IN MILLIMETERS.

	Femur	Patella + Tibia	Metatarsus	Tarsus	Total
I Leg	3.7	5.2	2.5	2.0	13.4
II Leg	3.6	?	?	?	13.0
III Leg	3.7	?	?	?	11.6
IV Leg	4.0	?	?	?	16.7
Pedipalp	2.3	3.1		2.0	6.4

The specimen is in the collection of Professor T. D. A. Cockerell of the University of Colorado and is from Florissant.

I am unable to place this species in any recent genus. It shows certain relationship with *Brachythele* which however have claws with a double series of teeth and other characters partly different partly indiscernible in *Eodiplurina cockerelli*.

SUB-ORDER ARACHNOMORPHÆ.

Spiders with an unsegmented abdomen and a single pair of lungs. Usually a single median tracheal spiracle in front of the spinnerets, sometimes a pair of them. Articulation of chelicerae such that the fangs move in a plane intersecting the plane of symmetry.

This sub-order can be naturally divided into two divisions:

I DIVISION CRIBELLATÆ.

True spiders with a cribellum in front of the spinnerets and a calamistrum on the fourth metatarsi.

Eight recent families belong to this division. Some of the species are exceedingly common. There are however no representatives of Cribellated spiders among the Tertiary spiders of North America.

2 DIVISION ECRIBELLATÆ.

True spiders without a cribellum or calamistrum. This division comprises 28 families of recent spiders. We shall mention only those families with which the Tertiary spiders are more or less directly concerned.

I SUB-DIVISION HAPLOGYNÆ.

This sub-division comprises six families of spiders in which the external genital organs are comparatively simple in structure and resemble those in Theraphosid spiders. Three of the six families, namely Oonopidæ, Dysderidæ and Caponiidæ, have two pairs of spiracles on the abdomen. In the Caponiidæ both pairs lead into tracheal tubes. In the Oonopidæ and Dysderidæ the first pair leads into lung-books, the second into tracheal tubes. In the remaining three families, namely Sicariidæ, Leptonetidæ and Hadrotarsidæ the spiracles are distributed so that a pair of them belongs to the lung-books, and a single median spiracle leads into the tracheal tubes.

The Caponiidæ have eight eyes, the Oonopidæ and Dysderidæ have six eyes. The Dysderidæ have a colulus in front of the spinnerets, the Oonopidæ have none.

FAMILY DYSDERIDÆ.

Characters of the family:—Two pairs of spiracles, the first of which belongs to lung-books, the second to tracheal tubes. Six eyes. Chelicerae long and obliquely inclined. Lip very long. Maxillary lobes parallel. Anterior coxæ long, cylindrical. Six spinnerets, anterior and posterior ones of about the same length while the median ones are sometimes shorter. Colulus present. Tarsi with two or three claws, upper claws with a single series of teeth, median claw smooth.

The sub-family *Segestriinæ* is characterized by the shape of the sternum which is much as in other spiders. The two genera, *Segestria* and *Ariadna*, of which the sub-family is composed, are separable by the position of their eyes and the structure of chelicerae. Both genera are widely distributed.

Genus *Segestria* Latreille.*Segestria secessa* Scudder (Textfigure 3).

Scudder, Tertiary Insects, 1890. P. 61. Pl. II. fig. 28.

Two females, one of these being No. 205 (now No. 71) of the Scudder Collection of the Museum of Comparative Zoology of Harvard University, the other Nos. 1806 and 1818 of the Princeton Collection. Both from Florissant.

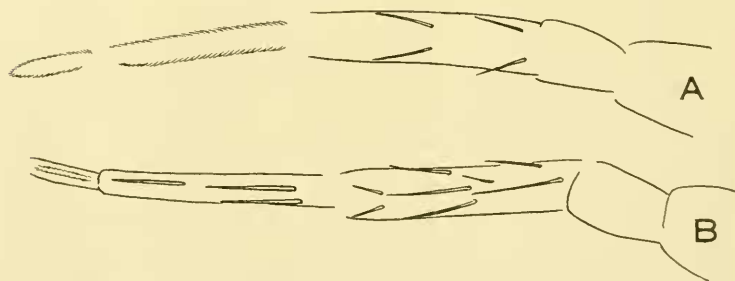


FIGURE 3.—*Segestria secessa* Scudder. Specimen No. 205 (71). Legs: a, first left; b, fourth left. $\times 13$.

The Harvard specimen is the type of the species and the only one which I have examined. It is a beautifully preserved specimen although the impression is rather faint. The spiracles are altogether indiscernible. The claws are too poorly preserved to

be studied under higher power and the sternum is not clear. The generic affiliation of the species is therefore entirely based on external similarity with recent representatives of the genus *Segestria*. Scudder's description and measurements are correct and need not be repeated here. It may be added that there are two pairs of spines on the underside of the first, second and third tibia (the first left leg is shown in *textfigure 3a*). The metatarsi of the third pair have also two pairs of spines below. The tarsi and metatarsi of the first and second pair of legs show a distinct scopula of short hair. The fourth pair of legs has more spines than any other, but the spines are not so regularly arranged (*textfigure 3b*). Legs in order 4123.



FIGURE 4.—*Segestria scudderi* n. sp. $\times 3.33$.

***Segestria scudderi* n. sp. (*Textfigure 4*).**

A single female No. 16379 (now No. 117) of the Scudder Collection of the Museum of Comparative Zoology in Harvard University.

The specimen is almost complete, but poorly preserved, the surface of the rock being eroded and uneven. The specimen presents only the ventral surface. It may be separated from the preceding species by its somewhat larger size and the greater length of the fourth pair of legs as compared with the first pair. Body and legs are covered with long, simple hair. There are many spines on all legs, apparently forming two ventral rows of three spines each on all tibiae and metatarsi, but the unevenness of the surface makes a definite counting impossible. The spiracles are not preserved, the spinnerets appear as a darker spot at the end of the abdomen, but their structure or number cannot be made out. The sternum is distinctly oval, longer than wide, but its margin is not clear. The chelicerae are strong, their fangs are not visible. The pedipalpi are both well preserved, slender and short. The legs are rather robust, in the order 4123. The total length including chelicerae is 11 mm. The carapace, not showing any outline of its margin, cannot be measured. The abdomen is 6.5 mm. long and 3 mm. wide and has more or less parallel sides.

MEASUREMENTS OF THE LEGS IN MILLIMETERS.

	Femur	Patella + Tibia	Metatarsus	Tarsus	Total
I Leg	3.2	3.1	1.6	1.4	9.3
II Leg	3.0	3.1	1.5	1.4	9.0
III Leg	3.0	2.4	1.5	1.5	8.4
IV Leg	3.6	3.7	2.3	1.8	11.4

I have placed this species represented by a single specimen from Florissant under the genus *Segestria* merely because of its external similarity with the preceding species.

2 SUB-DIVISION ENTELEGYNÆ.

This sub-division comprises twenty-two families of spiders in which the external genital organs are more complicated. In the female the genital opening is provided either with a *claustrum* or an epigynum. In the male the copulatory apparatus on the terminal joint of the pedipalp is provided with variously formed chitinized structures in addition to the embolus.

To the families recognized by Simon, only few of which we shall consider here, I thought it advisable to add a new family Parattidæ for the four species of Tertiary spiders referred to the genus *Parattus*.

FAMILY DRASSIDÆ.

Characters of the family:—Eyes eight, heterogeneous, forming two rows of four eyes each. Anterior median eyes alone diurnal. Maxillary lobes with a distinct obliquely transverse depression. Tarsi with two claws and unguis tufts. Anterior spinnerets far apart. Colulus wanting.

Genus *Palæodrassus*, new.

With the characters of the family. The appearance of the spinnerets makes it fairly certain that these spiders belong to the same family with recent Drassids, but it would be impossible either to place them under any recent genus or to separate the genus *Palæodrassus* from recent genera. It is very likely that in reality the species described under this genus belong to several genera. Four of the species may be readily separated from each other by the order of their legs which is 4123 in *P. ingenuus*, 4213 in *P. interitus* and *P. hesternus* and 4321 in *P. cockerelli*. The order of legs in *P. florissanti* is not known. Genotype: *P. ingenuus*.

Palæodrassus ingenuus (Scudder) (*Textfigures 5, 6*).

= *Titanocca ingenua* Scudder, Tertiary Insects, 1890. P. 69.
Pl. 11, figs. 29 and 32.

Four females from Florissant in the Scudder collection of the Museum of Comparative Zoology of Harvard University, numbered 9792, 11203, 13520, 14031 are mentioned in Scudder's work. Of these specimens however numbers 11203 (now No. 82) and 13520 (now No. 83) are the obverse and reverse of the same specimen, while No. 9792 (now No. 81) seems to belong to a different species, yet is too poorly preserved to warrant separation. I have not seen specimen 14031.

Scudder's description of this species refers entirely to Nos. 11203 and 13520 and is correct. He made a mistake in placing it in the genus *Titanocca* and in the family Agelenidæ to which that genus does not belong. I have already pointed out that the absence of a cribellum and calamistrum makes the retaining of this species in the genus *Titanocca* impossible. Nor do I think that there is any likelihood of its belonging to the family Agel-

enidæ, representatives of which are easily recognized because of the relative length of their posterior spinnerets. Nor can it be a Clubionid because its anterior spinnerets are not close together, but far apart.

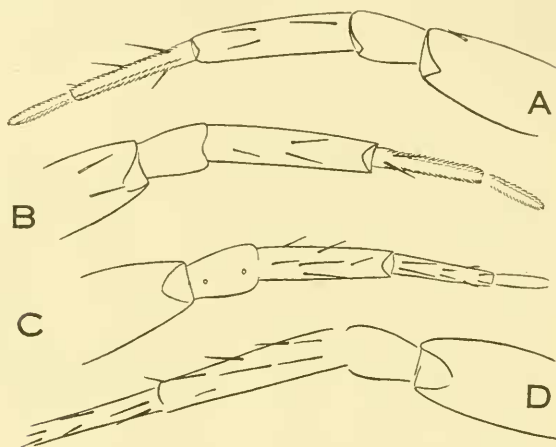


FIGURE 5.—*Palcoodrassus ingenuus* (Scudder). Specimen No. 13520 (83).
Legs: a, first left; b, second right; c, third right; d, fourth left. x 10.

The legs of this species are represented in our *textfigure* 5, the first and fourth being left legs, while the second and third right legs. It will be noticed that there is a distinct scopula on the first and second tarsi and metatarsi, a condition quite common among Drassids. There are three distinct spines on the underside of the first and second tibia, one of these close to the base, the other two forming a pair a little beyond the middle of the joint. There are also two or possibly three spines on the underside of the first and second metatarsi, and a pair of spines on the underside of the first and second femur close to the apical end of the joint. The spines on the third and fourth leg are more numerous. We find a median row of three equidistant spines on the underside of the tibiae accompanied by several lateral spines, and three pairs of spines on the underside of the metatarsi apparently accompanied by a pair of lateral spines. There are also two circular sockets for spines on the third patella, but the spines themselves are missing as spines are often broken off in life and still more commonly after death. Legs in order 4123.

The specimen of *Palacodrassus ingenuus* presents also the peculiar spectacle of a well preserved epigynum (*Textfigure 6.*) Scudder has entirely overlooked its presence. It is surrounded by hair and its appearance is best understood from the drawing which I have made with the aid of an Abbe Drawing apparatus

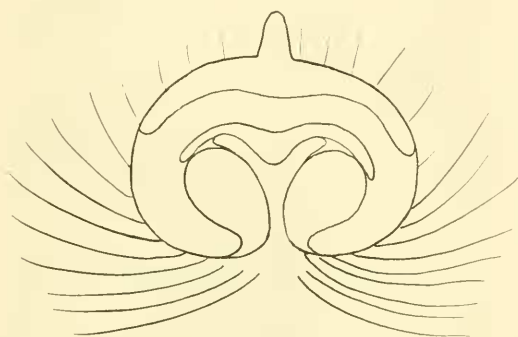


FIGURE 6.—*Palacodrassus ingenuus* (Scudder). Specimen No. 13520 (83). Epigynum. $\times 135$.

at a magnification of 135 diameters. It reminds more that of a *Gnaphosa* rather than *Drassodes*, but in absence of any evidence derived from the study of the lower margin of the chelicerae, which unfortunately is not distinct, the similarity in the epigynum would be insufficient to warrant the inclusion of the species in a definite genus.

Palacodrassus hesternus (Scudder) (*Textfigure 7*).

Titanocca hesternus Scudder, Tertiary Insects, 1890, p. 69.

Four females, Nos. 5656, 12006, 12977 and No. 1809 of the Princeton Collection. Of these Nos. 5656 (now No. 84) and 12006 (now No. 85) are the only ones which I have had opportunity to examine and are both in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

The description given by Scudder is correct and I cannot add anything material to it, except a figure of specimen No. 5656 and the statement that the spinnerets are indiscernible and that there is no calamistrum on the fourth metatarsi. No. 12006 is less com-

plete but at the same time the better preserved of the two specimens. The hair and the heavy, long spines on the legs are quite clear, and the scopulæ on the first and second tarsi and metatarsi are also very distinct. Legs in order 4213.



FIGURE 7.—*Palæodrassus hesternus* (Scudder). Specimen No. 5656 (84).
x 5.

***Palæodrassus florissanti* n. sp. (Textfigure 8).**

One female from Florissant in the T. D. A. Cockerell Collection of the University of Colorado.

The specimen presents the ventral surface with the outline of the carapace superimposed. The specimen is very poorly preserved and is referred to this indefinite genus on account of its spinnerets. Of these the anterior ones are cylindrical, far apart, the posterior ones much shorter, approximated and occupying the space between the anterior ones. Total length of the spider including chelicerae—7 mm. The abdomen is somewhat pressed out of shape and is 4 mm. long. Sternum longer than wide, pointed posteriorly, truncated in front, more or less oval in shape. Lip longer than wide. Chelicerae weak, pedipalpi slender. The legs are not complete except for the right second leg which is 5.1 mm. long. The femora are heavy, widest in their distal third. Strong spines, some of black color, are on all femora and on the

preserved sections of tibiæ. There is also simple hair covering the entire body and legs. Nothing else can be made out.



FIGURE 8.—*Palæodrassus florissantii* n. sp. $\times 5$.

***Palæodrassus cockerelli* n. sp. (Textfigure 9).**

One female from Florissant in the T. D. A. Cockerell Collection of the University of Colorado. (Two pieces, both showing the ventral surface of the same specimen.)

Preservation very poor. Total length 8.5 mm., abdomen 4.6 mm. long. The legs of the right side (left on the specimen) are complete, and in order 4321. Total length of leg I—4.8 mm., leg II—5.1 mm., leg III—5.2 mm., leg IV—7.2 mm. Scopula present on first and second tarsi and metatarsi. Spines on third and fourth femur, tibia and metatarsus. Spinnerets visible, but their structure indistinct. Simple hair on body and legs. Pedipalps slender.

Palæodrassus interitus (Scudder) (Textfigure 10).

= *Anyphæna interita* Scudder, Tertiary Insects, 1890, p. 67. Plate 11, fig. 5.

One female from Florissant, Nos. 8269 (now 80) and 8281 in



FIGURE 9.—*Palcodrassus cockerelli* n. sp. $\times 5$.

the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

That the spider in question does not belong to the genus *Anyphæna* under which Scudder had placed it "provisionally," induced to do so by "the general appearance of the specimen," cannot be doubted. In *Anyphæna* which is a Clubionid the anterior spinnerets are approximated and the tracheal spiracle is situated far in advance of the spinnerets. This spiracle may be seen in *Anyphæna* easier than in any other spider owing to the peculiar arrangement of the hair which forms two longitudinal lines parallel to each other and extending from the spiracle to the spinnerets. Scudder has not paid any attention to either of these characters. The spinnerets are represented in our figure 10 and are characterized by the wide separation of the anterior pair and the comparatively heavy appearance of the posterior pair. The median spinnerets are quite small. All spinnerets are covered with hair, but spinning tubes are not discernible. There is no trace of a spiracle but the arrangement of the hair on the abdomen does not

reveal anything in the shape of two parallel lines. The eyes cannot be made out clearly and I am unable therefore to verify Scudder's description of them. On the other hand the sternum,



FIGURE 10.—*Palæodrassus interitus* (Scudder). Specimen No. 8269 (80). Spinnerets. $\times 20$.

not mentioned by Scudder, is clearly visible and has the shape of a very regular oval. Legs in order 4213. Other characters as well as the measurements given by Scudder are correct and there is nothing I could add to them.

FAMILY CLUBIONIDÆ.

Characters of the Family:—Eyes eight, in two rows of four eyes each, usually only the anterior median eyes of the diurnal type. Maxillary lobes without obliquely transverse depression. Tarsi with two claws and unguis tufts. Anterior spinnerets approximated. Colulus wanting.

So close is the relationship between this family and Drassidæ that for a long time the two were regarded as a single family. Simon in his great work has placed the Clubionidæ after the Thomisidæ with whom they certainly have a great deal of relationship, and before the Agelenidæ. He has enclosed in the family the Selenopidæ and the Ctenidæ. I think these two are better regarded as separate families. It seems to me further that the Salticidæ (Attidæ) show also distinct relationship with some Clubionids both in structure and in habits.

The separation of the Clubionidæ into sub-families is based on the structure of the maxillary lobes, of the lip and of the posterior spinnerets and on the position of the tracheal spiracle immediately in front of or considerably in advance of the spinnerets:

Scudder has described four species of *Clubiona* and one species of *Anyphana*. The latter, as I have shown above, is a Drassid and not a Clubionid. Of the former I left only *Clubiona arcana* in the genus *Clubiona* on account of the order of the legs, which is the same as in recent species of that genus. For the other three species three new genera had to be established, based on the order of their legs. The number of species placed under the family Clubionidae has been increased to seven by the addition of three new species.

TABLE FOR THE SEPARATION OF TERTIARY GENERA OF CLUBIONIDS.

- | | | |
|----|------------------------------------|---------------------|
| 1. | The fourth leg is the longest..... | <i>Clubiona</i> |
| | *Not so | 2 |
| 2. | The first leg is the shortest..... | <i>Eobumbratrix</i> |
| | *Not so | 3 |
| 3. | Second leg as long as first | <i>Eoversatrix</i> |
| | *Second leg much shorter..... | <i>Eostentatrix</i> |

Genus *Clubiona* Latreille.

The genus *Clubiona* as limited and defined at present is much more restricted than it was when Latreille first proposed it. It is difficult to say whether the three species referred by me to this genus really belong to it. It did not seem necessary to create a new genus although a number of recent Clubionids possess the same order of legs. As applied to Tertiary spiders we may define this genus as possessing the characters of the family and the legs in order 4123.

Clubiona arcana Scudder.

Scudder, Tertiary Insects, 1890, p. 64. Plate 11, fig. 4 (♂).

Scudder describes one male No. 2831 and three females Nos. 3253, 7087 and 8082 of the collection in the Museum of Comparative Zoology of Harvard University and one female No. 1. 807 and 1. 819 of the Princeton Collection. I have examined only No. 2831 (now No. 73), No. 3253 (now No. 74) and No. 8082 (now No. 75). The females are poorly preserved. Scudder's description is accurate. It may be added that the spinnerets which are visible in the male are approximated and that the male copulatory apparatus has unquestionable similarity to that of

recent Clubionids. Of course, the details of its structure cannot be made out nor can it be decided whether the females belong really to the same species with the male.

Clubiona florissanti n. sp. (*Textfigure 11*).

One female from Florissant in the collection of T. D. A. Cockerell of the University of Colorado.

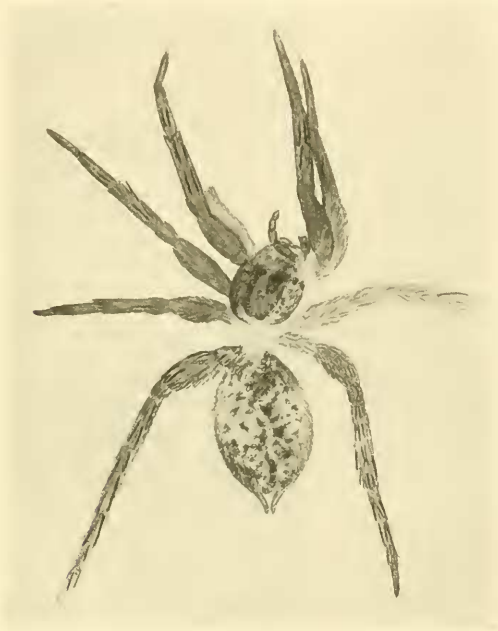


FIGURE 11.—*Clubiona florissanti* n. sp. $\times 5$.

The specimen is almost complete, but poorly preserved. It is even impossible to decide which surface is preserved, although the presence of spines in the median line of the legs makes one think that we have the dorsal surface before us. Total length 6.5 mm. Abdomen oval, 4.2 mm. long, 2.7 mm. wide in the middle. Measurements of legs:—First leg—6.1 mm., second—5.7 mm., third—5.0 mm. and fourth—6.8 mm. The individual joints are not clearly separable. Body and legs are clothed with simple

brown hair. It is difficult to decide whether the first and second tarsi have a scopula or not. There are many distinct spines on the legs, but their arrangement is not clear. The spinnerets are approximated, but displaced and poorly discernible. No other structures can be made out satisfactorily.

Clubiona curvispinosa n. sp. (*Textfigure 12*).

One female from Florissant, No. 16377 (now No. 120) in the Scudder Collection of the Museum of Comparative Zoology of Harvard University. The specimen presents the ventral surface

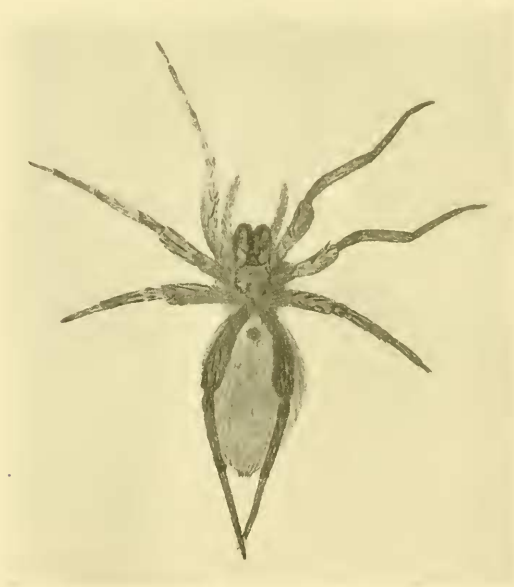


FIGURE 12.—*Clubiona curvispinosa* n. sp. $\times 5$.

and is complete, but rather poorly preserved. The legs of the fourth pair are superimposed over the abdomen, meeting far beyond its end. Total length of the spider—6.9 mm. Immediately behind the fourth coxæ which are contiguous, a darker area in the middle line apparently represents the epigynum. The spinnerets appear as a similar dark area at the end of the abdomen, but neither their shape nor their number can be made out. Tak-

ing these two areas as points for measurement we may assume that the abdomen is approximately 4.2 mm. long. The outline of the carapace is also visible, though indistinctly. The carapace seems to have been pressed out of shape, but in the live spider was probably very wide in front. The legs are in order 4123. The fourth leg is 7.6 mm. long, the first—6.3 mm. The interesting feature of the armature of the legs is furnished by the strong, curved spines on all femora. Less powerful but also curved spines are found on all other joints except the tarsi. The fourth tarsi alone are well preserved and are thickly clothed with hair. Entire body and legs are covered with both long and short, simple hair. No other structures are discernible.

Genus **Eoversatrix**, new.

With the characters of the family, but with the legs in order 1243. Genotype: *E. eversa*.

Eoversatrix eversa (Scudder).

= *Clubiona eversa* Scudder, Tertiary Insects, 1890, p. 63.
Plate II, fig. 22 (♂).

Scudder describes two males from Florissant, Nos. 5944 and 8551. Of these I have seen only the former which is now No. 72 of the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

Scudder's description is very good and need not be repeated here. All I have to add is that body, palpi and legs are clothed with simple hair. Also, Scudder does not mention the spinnerets which however are well distinguishable notwithstanding the fissure in the specimen. While one may not make out the details of their structure, it seems to be certain that they are all approximated. The order of legs 1243 is sufficient for the separation of this species in a separate genus, since in all recent species of *Clubiona* the fourth leg is the longest.

Genus **Eobumbratrix**, new.

With the characters of the family, but with the legs in order 2431. Genotype: *E. latebrosa*.

Eobumbratrix latebrosa (Scudder).

= *Clubiona latebrosa* Scudder, Tertiary Insects, 1890, p. 65
Plate II, fig. 18 (♂).

One male from Florissant in the Scudder Collection of the Museum of Comparative Zoology of Harvard University, No. 6492 (now No. 76).

The description of Scudder is correct. The spinnerets are scarcely discernible, but seem to be approximated. The order of legs 2431 removes this species from all genera of recent Clubionids in which the third leg is always the shortest.

Genus **Eostentatrix**, new.

With the characters of the family, but with the legs in order 1423. Genotype: *E. ostentata*.

Eostentatrix ostentata (Scudder) (*Textfigure 13*).

= *Clubiona ostentata* Scudder, Tertiary Spiders, 1890, p. 65.
Plate II, fig. 24 (♂).

Two males Nos. 199 (now No. 77), 5507 and 5910 (now No. 78) and one female No. 9624 (now No. 79) from Florissant in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

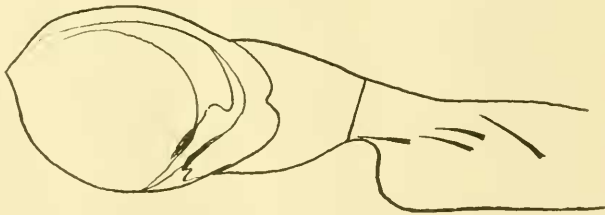


FIGURE 13.—*Eostentatrix ostentata* (Scudder). Specimen No. 5910 (78).
Left pedipalp. x 40.

Scudder's description is correct. It may be added that the spinnerets are clearly visible in the male specimen No. 5910 and are approximated. The same specimen shows the pedipalps beautifully. The bulb of the copulatory apparatus has the appearance of recent Clubionids. The tibia of the pedipalp is distally

enlarged owing to the presence of an apophysis. The patella of the pedipalp has also an apophysis and is besides provided with four spines. The structure of the copulatory apparatus itself is not distinct, but appears as a dark area with curved edge possibly representing a long curved embolus. Legs in order 1423.

The female is very poorly preserved and it is impossible to decide whether she actually belongs to the same species.

***Eostentatrix cockerelli* n. sp. (Textfigure 14).**

One female from Florissant in the collection of T. D. A. Cockerell of the University of Colorado.

The specimen is well preserved and shows the ventral surface with the outline of the carapace impressed over the coxæ. Total length 11 mm. Carapace 3.1 mm. long, 3.1 mm. wide, subrotund. Abdomen 5.5 mm. long, 4.8 mm. wide, joined to the carapace by a long petiolus. Chelicerae weak, slightly divergent. Pedipalpi slender and somewhat longer than carapace. Legs in order 1423. First leg—16.1 mm. long, second—15.0 mm., third—12.8 mm., fourth—15.9 mm. They are clothed with simple hair. Strong spines are present on all legs, but they are not numerous, nor can their arrangement be made out clearly. The spinnerets are approximated, the posterior ones longer than the anterior ones, clothed with simple hair, but spinning tubes indiscernible. The body is also covered with simple hair which is long and brown in color. Nothing else can be made out.

FAMILY PARATTIDÆ, NEW.

A family of extinct spiders of the sub-order Arachnomorphæ, division Ecribellatæ and sub-division Entelegynæ, having a general resemblance to Attids and jumping Clubionids and probably closely related to both. In absence of other tangible characters on account of the poor preservation of the specimens, the family may be characterized by the arrangement and proportion of the eyes, as described for *Parattus oculus*, the main points being, that the eyes are round, in two rows of four eyes each, anterior eyes subequal and fairly equidistant, posterior eyes considerably smaller, the posterior median eyes situated between and slightly behind the anterior median eyes.



FIGURE 14.—*Eostentatrix cockerelli* n. sp. x 3.3.

Genus *Parattus* Scudder.

With the characters of the family.

Parattus resurrectus Scudder (*Textfigure 15*).

Scudder, *Tertiary Insects*, 1890, p. 53, Plate 11, fig. 26 (♀?).

One male No. 1081 (now No. 64) and one female Nos. 8459 and 8282 (now 65) from Florissant in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

I have discussed this case above and have little to add. Our *textfigure 15* shows the arrangement of the spines on all legs. As

the legs on the right side are completely preserved we can state positively that there is no scopula either on the tarsi or metatarsi. The claws are not well discernible, but it seems that there are only

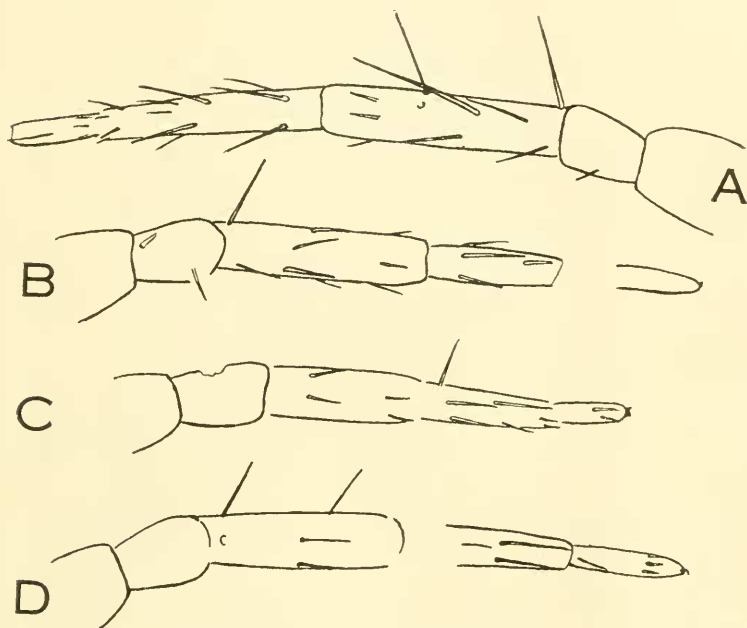


FIGURE 15.—*Parattus resurrectus* Scudder. Specimen No. 8282 (65). Legs: a, first left; b, second right; c, third right; d, fourth right. x 20.

two claws and that both are smooth. It would be impossible to decide whether the two specimens represent the male and the female of the same species. Legs in order 1243.

Parattus evocatus Scudder (Textfigure 16).

Scudder, Tertiary Insects, 1890, p. 54.

One female, No. 12005 (now No. 66) from Florissant in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

It is difficult to ascertain whether Scudder's description of the species is correct or erroneous. At one time I thought to see two rows of eyes, more or less equidistant and equal in size, one pro-

curved, the other recurved, but on reëxamination after the lapse of some time I was unable to verify my own rough sketch. Each femur shows a median row of three spines above and two or three



FIGURE 16.—*Parattus evocatus* Scudder. Specimen No. 12005 (66). $\times 5$.

lateral spines. Body and legs are clothed with simple hair visible under higher power.

Parattus latitatus Scudder (*Textfigure 17*).

Scudder, *Tertiary Insects*, 1890, p. 55.

One specimen from Florissant, No. 9823 (now No. 67) in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

The specimen is very poorly preserved and its sex as well as its generic affiliation remains uncertain. As far as can be ascertained, Scudder's description is correct. There are a few stout spines visible on the legs which are incomplete. The body is covered with simple hair.



FIGURE 17. *Parattus latitatus* Scudder. Specimen No. 9823 (67). x 5.

***Parattus oculatus* n. sp.** (*Textfigures 18 and 19*).

One female from Florissant, No. 118 of the Scudder Collection of the Museum of Comparative Zoology of Harvard University.



FIGURE 18.—*Parattus oculatus* n. sp. Specimen No. 118. x 5.

An exceedingly poorly preserved specimen apparently presenting the dorsal aspect although there is no clear outline of the

carapace. Here and there a few spines may be seen on the legs, but even the lines between the joints cannot be made out. It is a small stout spider measuring 7 mm. in length. Order of legs 1.2.4.3. Total length of leg I—8.0 mm., leg II—7.5 mm., leg III—6.8 mm., leg IV—7.2 mm.

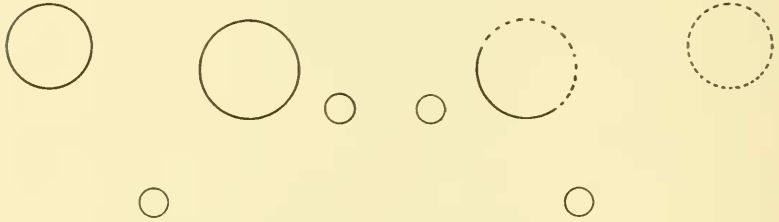


FIGURE 19.—*Parattus oculatus* n. sp. Specimen No. 118. Eyes. $\times 70$.

The only really well preserved organs are the eyes (*textfigure 19*). They are eight in number and apparently only the right anterior lateral eye is completely indiscernible. Of the right anterior median eye a part of the outline is preserved and the remaining eyes are clearly visible. The anterior row is slightly procurved and much longer than the strongly recurved posterior row. The anterior median eyes are the largest and are about 1.75 their diameter apart. The anterior lateral eyes are also large, but distinctly smaller than the anterior median eyes and are separated from the latter by 1.50 their diameter. The eyes of the second row are considerably smaller, their diameter being about 3.50 times smaller than the diameter of the anterior median eyes. All eyes of the second row are of the same size. The posterior median eyes are situated between and slightly behind the anterior median eyes, are twice their diameter apart from each other and about one diameter from the respective anterior median eye. The posterior lateral eyes are behind and to the outside of the anterior median eyes from which they are removed by three diameters, while the distance between the posterior lateral and posterior median eyes is about six of their diameters. This arrangement of the eyes agrees closely with the description given by Scudder for *Parattus resurrectus* and is the reason why I have placed the otherwise so poorly preserved specimen without hesitation under the genus *Parattus*.

FAMILY THOMISIDÆ (LATERIGRADÆ).

Characters of the Family:—Eight eyes in two rows, all diurnal, lateral eyes largest. Legs modified for lateral, crab-like locomotion. Tarsi with two claws, with unguual tufts. Spinnerets contiguous, with a distinct colulus in front of them.

Although several groups of spiders have laterigrade locomotion, the Thomisids are usually easily recognizable. Usually they are smaller than either the Selenopidæ or the Heteropodidæ and are distinguishable from the former by the position of the eyes and from the latter by the structure of the metatarsi. Moreover neither of these has a colulus. The generic distinction of Thomisids involves the study of the maxillary lobes, lip, sternum, margins of chelicerae, hair etc., all characters not sufficiently apparent or completely indiscernible in extinct specimens. The three species which Scudder refers to the genus *Thomisus* are unquestionably Thomisids and his choice of genus is fortunate, for we may again regard it as merely a representative, indeterminate genus.

Genus *Thomisus* Walckenaer.*Thomisus resutus* Scudder.

Scudder, Tertiary Insects, 1890, p. 57, Plate II, fig. 13.

A single specimen of uncertain sex from Florissant, Nos. 5502 (now No. 68) and 7521 in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

The specimen is poorly preserved and its description given by Scudder is correct in all details.

Thomisus disjunctus Scudder.

Scudder, Tertiary Insects, 1890, p. 58, Plate II, fig. 9.

Scudder describes two specimens from Florissant, one No. 9677 (now No. 69) in the Scudder Collection of the Museum of Comparative Zoology of Harvard University, the other No. 10377 which I have not seen.

Scudder's description is correct except for his statement that "the tibiae and first tarsal joint are completely consolidated into a single piece, so that the line of demarkation can not be seen." Examination of the legs under higher power reveals the pres-

ence of a semicircle of short hair, marking the end of the tibia and the beginning of the interarticulate membrane between the tibia and the metatarsus. Short hair is discernible on all joints of the legs.

Thomisus defossus Scudder (*Textfigure 20*).

Scudder, Tertiary Insects, 1890, p. 59, Plate 11, fig. 23 (δ).

One male from Florissant, No. 4742 (now No. 70) in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

Scudder's description is correct and all I have to add is that I was able to expose the end of the third right tarsus and thus reveal the presence of two curved claws (*textfigure 20*). The left claw is somewhat turned sideways and partly covered with what seems to be hair but may be remnant of flat sharp-pointed unguis tufts. The right claw shows distinctly a single median tooth.

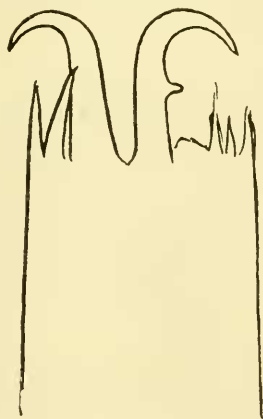


FIGURE 20—*Thomisus defossus* Scudder. Specimen No. 4742 (70). Claws of right third foot. $\times 135$.

FAMILY LINYPHIIDÆ.

Characters of the Family:—Eight eyes in two rows, anterior median eyes alone diurnal. Spinnerets approximated, preceded by a colulus. Chelicerae with oblique margins. A stridulating organ on the outer surface of the chelicerae with a corresponding part on the inner surface of the pedipalpi. No comb on fourth tarsi. Clypeus high.

The separation into sub-families is based chiefly on the structure of the palpi in both sexes and the separation into genera on characters the majority of which are not easily ascertainable even in recent forms, especially in the case of females. Most of the recent spiders belonging to the sub-family Erigoninæ are minute, those of the sub-family Linyphiinæ larger and often resembling Theridiids with which they were originally classified, but from which they are easily separable by the structure of their fourth tarsi and chelicerae.

Genus *Linyphia* Latreille.

Scudder has placed a single species under this genus. I have placed under it Scudder's *Theridium seclusum* which is certainly not a Theridiid and two new species. All these species have the general appearance of recent Linyphias, but it is impossible to say whether they actually belong to this genus.

Linyphia seclusa (Scudder).

= *Theridium seclusum* Scudder, Tertiary Insects, 1890, p. 74, Plate II, fig. 20 (♂).

Scudder described three specimens, but one of these is a distinctly different species and has been placed by me under the genus *Palæopachygnatha*. This leaves two specimens of which No. 7816 I have not seen. The figure and description given by Scudder refer to specimen No. 9026 (now 88) of the Collection of the Museum of Comparative Zoology of Harvard University, which I have carefully examined.

It is a well preserved male. The description given by Scudder is correct. It must be added that the fourth tarsi are well preserved and show no trace of a comb. There are distinct spines of the Linyphiid type on all joints except tarsi.

Linyphia retensa Scudder.

Scudder, Tertiary Insects, p. 75, Plate II, figs. 25, 27 (♂).

A single male and its reverse have been described by Scudder under the Nos. 12976, 13212 and 14032. Of these I have seen only No. 12976 (now No. 89) of the Scudder Collection of the Museum of Comparative Zoology of Harvard University. The

specimen is very poor and as far as I can judge Scudder's description is correct.

Linyphia florissanti n. sp. (Textfigure 21).

One specimen, probably a male, from Florissant in the T. D. A. Cockerell Collection of the University of Colorado. It is very poorly preserved.

I am not at all certain under which family this specimen should be placed. There are no spines on the legs which are clothed with simple hair. The claws are not preserved, the eyes are indiscernible, neither can the spinnerets be seen. Only its general appearance reminds of a Linyphiid.

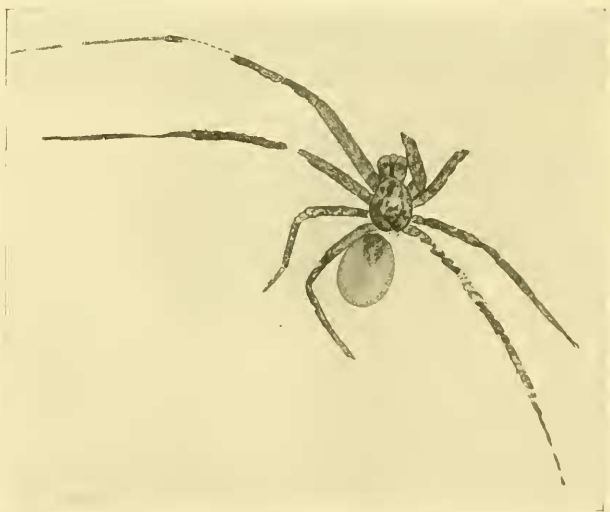


FIGURE 21.—*Linyphia florissanti* n. sp. x 3.33.

Total length including chelicerae—6.2 mm. Carapace longer than wide, being 2.1 mm. long and 1.9 mm. wide in the widest place, i.e. between the second and third coxae. It is eggshaped, pointed anteriorly. The outline of the sternum appears impressed inside the carapace. Its anterior end is not clearly visible, but the first coxae are distinctly widely separate. The posterior end of the sternum is pointed, slightly yet distinctly separating the fourth

coxæ. The chelicereæ are large and heavy. A dark area not shown in the drawing, but having the appearance of a copulatory apparatus of a male pedipalp, is visible at a little distance in front of the chelicereæ. The abdomen is perfectly oval. The legs are long, in order 1243. The end of the first leg is difficult to trace, but the entire leg is considerably heavier than the fourth leg. Measured to its visible end it is 15.7 mm. long, the second leg—13 mm., the third—6 mm., and the fourth—9 mm.

***Linyphia pachygnathoides* n. sp. (Textfigures 22 and 23).**

One male from Florissant, No. 38124 in the Collection of the U. S. National Museum.



FIGURE 22.—*Linyphia pachygnathoides* n. sp. Specimen No. 38124. $\times 3.33$.

The name chosen for this species is to indicate a close resemblance in the structure of its pedipalp to that in the recent genus *Pachygnatha*. As our *textfigure 23* shows, the tibia of the pedipalp has no apophysis. The end of the tarso-metatarsal joint pro-

jects beyond the copulatory apparatus. The structure of the latter is not clearly discernible, yet it seems to have a more or less spiral arrangement as indicated by dark streaks represented as lines in the drawing.

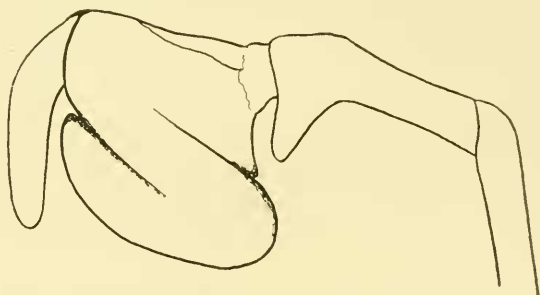


FIGURE 23.—*Linyphia pachygnathoides* n. sp. Specimen No. 38124. Right pedipalp. $\times 70$.

Total length of spider—about 4 mm. Abdomen—2.5 mm. long, 1.3 mm. wide. The legs are slender, in order 1243. They are covered with short brown hair. Here and there a few weak, short spines are visible, forming various angles with the axis of the leg (from 24 to 58 degrees). The separate joints are clearly visible only in the first pair of legs. Here the femur measures 3.7 mm., patella with tibia—4.5 mm., metatarsus with tarsus—6.8 mm., total 15.0 mm. In the second leg only the metatarsus is clearly separated from the tibia and together with the tarsus measures 5.0 mm., while the total length of this leg is 12 mm. The third pair of legs is poorly preserved and cannot be even correctly measured. As far as visible it measures about 5 mm. The fourth pair of legs is complete although separation of the joints is not clear. Its total length is 9 mm.

FAMILY ARGIOPIDÆ.

Characters of the Family:—Eight eyes in two rows, all diurnal. Spinnerets approximated, preceded by a colulus. Chelicerae with oblique margins with several teeth. Legs with spines. Tarsi with three claws and with several spurious claws (serrated bristles).

The family is usually divided into three sub-families which may be distinguished as follows:

- Chelicerae without boss at base. Tetragnathinae
 Chelicerae with a boss at base
 Lip longer than wide Nephilinae
 Lip wide and short. Epeirinae

SUB-FAMILY TETRAGNATHINÆ.

Genus *Palaeometa*, new.

Presumably with the characters of the sub-family, but with eyes on a transversely oval elevation. Genotype: *P. opertanea*.

Palaeometa opertanea (Scudder).

= *Theridium opertaneum* Scudder, Tertiary Insects, 1890, p. 73.
 Plate 11, fig. 3 (♀).

One female from Florissant, No. 13521 (now No. 86) in the Collection of the Museum of Comparative Zoology of Harvard University.

The specimen is imperfectly preserved and inadequately described by Scudder. Total length 11 mm. Carapace 5.0 mm. long, 2.2 mm. wide, abdomen 6.4 mm. long, almost globular. The legs are slender, imperfectly preserved. The third and fourth leg of the left side appear superimposed over the abdomen, the tip of the fourth leg protruding beyond the abdomen and at the first glance simulating a spinneret. However, it is not difficult to trace the leg on the surface of the abdomen owing to the arrangement of the hair which presents a different direction from that of the hair covering the abdomen, as the leg lies at an angle to the main axis of the spider. There are distinct spines on the first and second pair of legs, giving them an appearance entirely different from that of recent Theridiids. Moreover there is no trace of a comb on the fourth tarsus. This makes the retention of the species in the genus to which Scudder referred it impossible. The proportion of the femora indicates the probable proportion of the legs and is as given by Scudder: first femur—6.0 mm., second—5.0 mm., third—2.0 mm., fourth—3.25 mm.

The carapace shows a large transversely oval area which has the shape of a depression in the rock and which therefore represented an elevation in life. It seems probable that this represents the entire eyegroup, but the individual eyes cannot be made out. No other structures are discernible.

Genus *Palæopachygnatha*, new.

Spiders resembling recent *Pachygnatha*. Chelicerae strongly divergent. Genotype: *P. scudderi*.

Palæopachygnatha scudderi n. sp. (Textfigure 24).

= *Theridium seclusum* Scudder ad partem specimen No. 2286 (now No. 87) in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.



FIGURE 24.—*Palæopachygnatha scudderi* n. sp. Specimen No. 2286 (87).
x 3.33.

One specimen from Florissant, probably a female.

This species, which Scudder has erroneously identified with his *Theridium seclusum*, is at once easily separable from the latter by the difference in the relative length of its legs and the appearance of its chelicerae. The chelicerae are strongly divergent, a circumstance which decided me in placing the species under a genus allied to *Pachygnatha* with which the spider has external resemblance. The specimen has a very faint appearance, yet is well preserved. Its anterior legs as well as the legs of the second pair are broken off across the femora. The third and fourth pair are complete, but the claws are indiscernible. There is no trace of a comb on the fourth tarsi. The legs are clothed with simple brown hair and show a few spines. One of the spines is plainly

visible on the third right tibia, two spines on the fourth left metatarsus.

Total length with chelicerae 7 mm. Carapace oval, apparently slightly longer than wide, although its anterior edge is not clearly defined. The abdomen is oval. The total length of the third leg is 7.1 mm., that of the fourth—11.6 mm. The pedipalpi are not discernible.

Palæopachygnatha cockerelli n. sp. (Textfigure 25).

One male from Florissant in the T. D. A. Cockerell Collection of the University of Colorado.



FIGURE 25.—*Palæopachygnatha cockerelli* n. sp. x 3.33.

The specimen, presenting the dorsal surface only, is not very well preserved and little detail can be made out. In general the spider has the appearance of a recent *Pachygnatha*. The chelicerae are hidden under the copulatory apparatus of the pedipalpi,

but are apparently divergent. The carapace is slightly longer than wide. The abdomen is oval, widest in its middle, evenly narrowed at both ends. Legs in order 1243. They are clothed with simple brown hair. There are distinct spines on all legs, especially on the femora.

Total length of spider about 6.8 mm. The first leg measures 13.5 mm., the second—10.5 mm., the third—4.5 mm., and the fourth—9 mm.

Genus *Tetragnatha* Latreille.

Tetragnatha tertiana Scudder (*Textfigure 26*).

Scudder, Arachnida in Zittel's Handbuch der Paleontologie, Vol. I, 11, p. 744, Fig. 927, 1885.

Scudder, Tertiary Insects, 1890, p. 77, Plate 11, fig. 11 (δ).

One male from Florissant, Nos. 5000 (now No. 62) and 5898 (now No. 90) in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

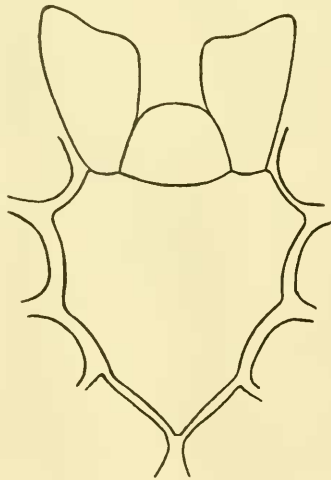


FIGURE 26.—*Tetragnatha tertiana* Scudder. Specimen No. 5898 (90).
Sternum, lip and maxillary lobes. $\times 13$.

A very well preserved specimen. Scudder's description is not complete omitting to mention such structures as the lip, maxillary lobes, sternum and spinnerets. Moreover he mistook the maxillary lobes for what he terms "the basal piece of the mandibles."

The sternum, represented in our *textfigure 26*, is wide in front, pointed behind, scarcely separating the hind coxæ. It is slightly emarginate anteriorly, receiving the wide underlip at the sides of which the maxillary lobes may be seen. They are more or less typical of *Tetragnatha* being considerably wider at the end than at the base and in a general way parallel to each other.

In front of the maxillary lobes the chelicerae may be plainly seen. They have been probably pressed out of their position as their base is now in contact with the anterior edge of the maxillary lobes, a circumstance which misled Scudder in his interpretation of these structures. The chelicerae are comparatively short and stout and strongly divergent. The left shows the fang complete. It is a little shorter than the basal joint, lighter in color, smooth and slightly but evenly curved. Considering that the specimen is unquestionably a male the chelicerae are not typical, or perhaps I should better say not of the extreme type found in some recent species of the genus, but more of the type of the recent female *Tetragnatha laboriosa*. Impressions of the copulatory apparatus of the pedipalpi may be seen at a little distance in front of the chelicerae, but the other joints of the pedipalp, which probably was slender, are not discernible.

The carapace is clearly visible on the specimen No. 5000 (now No. 62). Its anterior edge extends a little beyond the base of the chelicerae, cutting them across. I have mentioned that the chelicerae are apparently dislocated. The median line of the carapace comes to lie not between the chelicerae, but slightly to the left, so that of the eyes which are plainly impressed across the base of the chelicerae the right median eye lies in the juncture line of the two chelicerae. The carapace is anteriorly narrower than posteriorly. Its widest place is between the second and third pair of coxæ where it measures 2.6 mm. while the length of the carapace is 3.5 mm. It is therefore distinctly longer than wide and oval in shape. Between the posterior edge of the carapace and the anterior edge of the abdomen a narrow space is bridged by the petiolus which has the shape of an elongated pentagon with the apex reaching the sternum and with sides slightly concave. Measured without the petiolus the abdomen is 4.6 mm. long and 2.3 mm. wide. The total length of the spider including chelicera is 10 mm.

The two rows of eyes are very slightly recurved and the posterior row slightly longer than the anterior row. All eyes are round

and subequal in size, only the anterior median ones slightly but distinctly smaller than the others. The eyes of the anterior row are separated from each other by equal distances measuring less than their diameter, but more than their radius. The same is true of the posterior row, the greater length of this row being due to the equal size of its eyes and to the ever so slightly greater distance between them. The rows are to all purposes parallel and the free distance between the rows is twice the diameter of the eyes. The quadrangle of the median eyes is therefore considerably longer than wide. The clypeus is unusually narrow, measuring less than the diameter of the anterior middle eyes. It may be added that the eyes of the anterior row are quite plainly visible, while those of the posterior row are discernible only when the light falls under a certain angle.

The spinnerets are well preserved on specimen No. 5898 (now No. 90). The anterior pair is almost contiguous. They have the appearance of brown discs with a smaller and well circumscribed disc inside the larger. This represents probably the terminal article of the spinneret, but no spinning tubes are discernible. The posterior spinnerets are smaller and are separated from each other by at least their diameter. Between the posterior spinnerets there is a darker area possibly representing the median spinnerets. In front of the spinnerets the colulus can be plainly seen as a small brown disc.

The first and second pair of legs are broken off apparently across the tibiae. The third and fourth pair are complete. Scudder did not see the ends of their tarsi. When fully exposed the third leg measures 9.8 mm., the fourth—19.2 mm. The length of the femora is given correctly by Scudder as follows:—First femur 8.75 mm., second—7 mm., third—3.5 mm., fourth—7 mm. One can see median and lateral spines on all femora and tibiae and some spines on fourth metatarsi. The hair is very faintly visible on legs, but is indiscernible elsewhere.

SUB-FAMILY NEPHILINÆ.

Genus *Nephila* Leach.

Nephila pennatipes Scudder.

Scudder, Arachnida in Zittel's Handbuch der Paleontologie, 1885, Vol. 1, ii, p. 744, fig. 926.

Scudder, Tertiary Insects, 1890, p. 89, Plate 11, fig. 12.

One female, No. 11651 (now No. 61) from Florissant in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

Scudder's description is entirely correct in every detail.

SUB-FAMILY EPEIRINÆ.

This is a very large sub-family and the separation into groups and genera is based on many characters, some of which may be expected to remain preserved even in paleontological material, while others, like the difference in the structure of the inner and outer claws, certainly would not be discernible. Scudder places under the genus *Epeira* six distinct species, one specimen which is only partly preserved and several pieces with nothing but a leg on each. He also refers four species to a genus *Tethneus* established by him for these species. The history of the genus *Epeira* and its prototype *Aranca* shows how difficult it is to find permanent characters by which to distinguish the spiders referred to *Epeira* and a dozen or so of related genera. I consider it a mistaken attitude to abolish the genus *Tethneus* which after all is not applicable to recent spiders, and shall quote here the definition given by Scudder.

Genus *Tethneus* Scudder.

Spiders "compact in form, with short and stout legs of not very unequal length, and in particular the first two pairs of legs are unusually heavy. The second and fourth pairs of legs are of nearly equal length, or the second pair may be slightly longer; the femora of the first and second pairs of legs are at base as broad as or even broader than half the width of the cephalo thorax, and the longest legs are less, generally considerably less, than twice as long as the body" (p. 78).

Besides the four species described by Scudder I refer to this genus two new species.

Tethneus guyoti Scudder (*Textfigure 27*).

Scudder, Tertiary Insects, 1890, p. 78, Plate 11, figs. 8 (♂),
10 (♀).

Scudder described one female, No. 320 (now No. 91) and one

male, Nos. 8265 (now No. 92) and 8311 in the Collection of the Museum of Comparative Zoology of Harvard University and one male, Nos. 1. 808 and 1. 854 in the Princeton Collection. I have examined only Nos. 320 and 8265.

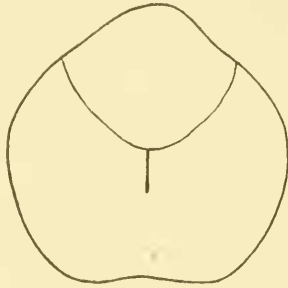


FIGURE 27.—*Tethneus guyoti* Scudder. Specimen No. 8265 (92). Carapace.
x 13.

Scudder's description of the carapace is not quite correct. It is much narrowed in front (*textfigure 27*). The cephalic area is clearly separated by the cephalothoracic groove. A longitudinal groove begins at the cephalothoracic groove and runs backwards for a little over one-third of the length of the thoracic area. Neither eyes nor claws can be made out. The legs are covered with brown hair. Here and there one can see spines, but these are poorly preserved and barely discernible. The female undoubtedly presents the ventral aspect, but is so poorly preserved that nothing but the legs can be seen more or less clearly. Under such circumstances it is absolutely impossible to say whether the female belongs to the same species with the male.

The measurements given by Scudder are correct.

Tethneus obduratus Scudder.

Scudder, Tertiary Insects, 1890, p. 79, fig. 31 (♀).

One female from Florissant, No. 7177 (now No. 93) in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

This specimen is very poorly preserved and the description given by Scudder, as far as can be ascertained, is correct.

Tethneus hentzii Scudder (*Textfigures 28 and 29*).

Scudder, Arachnida in Zittel's Handbuch der Paleontologie, 1885, Vol. I, ii, p. 744, fig. 928.

Scudder, Tertiary Insects, 1890, p. 80, Plate II, fig. 14 (♂).

Scudder describes seven specimens, all males, Nos. 1226 (now No. 63), 1447 (now No. 94), 3860 (now No. 95), 6600 (now No. 96), 8635 (now No. 98) and its reverse 8533 (now No. 97), 14982 (now No. 99) and 8689, all in the Collection of the Museum of Comparative Zoology of Harvard University. Of these

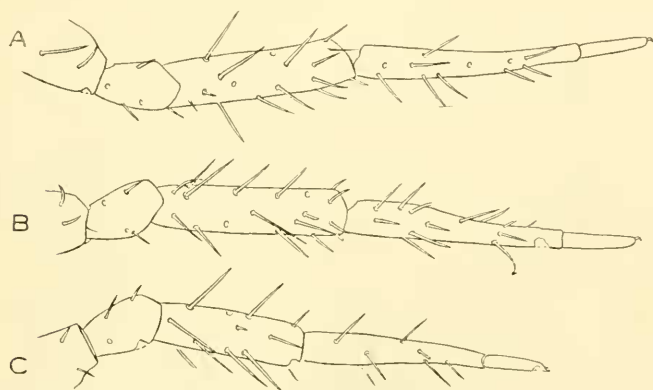


FIGURE 28.—*Tethneus hentzii* Scudder. Specimen No. 8635 (98). Legs: a, first right; b, second right; c, third right. x 10.

I have seen only specimen No. 8689. Scudder's description and measurements are correct. The best preserved specimen is that which is now numbered 97 and 98. Our *textfigure 28* shows the arrangement of spines on the first, second and third legs. The fourth leg does not possess as many spines, but as it is less perfectly preserved I refrain from giving a drawing of it. The legs are complete and show the claws. Only one claw however is really perfectly preserved. It is an upper claw of the first left leg of specimen No. 98 and is reproduced in our *textfigure 29* at a magnification of 440 diameters as drawn with the aid of an Abbe drawing apparatus.

Scudder's description of the species and his measurements are correct and I have nothing more to add to them.

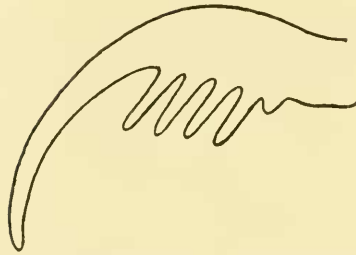


FIGURE 29.—*Tethneus hentzii* Scudder. Specimen No. 8635 (98). A claw of the first left foot. x 440.

Tethneus provectus Scudder (*Textfigure 30*).

Scudder, Tertiary Insects, 1890, p. 81, Plate II, fig. 21 (♀).

One male and three females from Florissant, Nos. 8141 (now No. 100), 13519 (now No. 101), and its reverse 13522 (now No. 102), 14991 (now No. 103) and 13524, all in the Collection of the Museum of Comparative Zoology of Harvard University. The last mentioned specimen I have not seen.

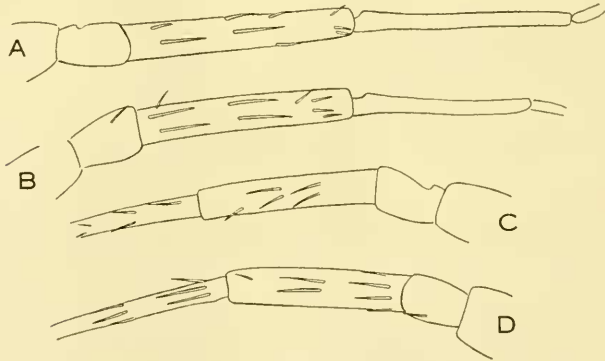


FIGURE 30.—*Tethneus provectus* Scudder. Specimen No. 14991 (103). Legs: a, first right; b, second right; c, third left; d, fourth left. x 10.

It is difficult to say whether all specimens belong to the same species. The arrangement of the spines on the legs of specimen No. 103 is shown in our *textfigure 30*. This being a male, a comparison with the preceding species is in order, and shows that *T. provectus* has not nearly as many spines as *T. hentzii*, but that

its spines have a more regular arrangement. Mention must be made of the presence of hair in the area behind what Scudder described as the abdomen in specimen No. 13522. The hair covered area extends all the way to the end of the hind legs. If this area represents the actual end of the abdomen, as is very likely, then the abdomen is much longer than it is represented in Scudder's description. In every other respect his description is correct.

Tethneus twenhofeli n. sp. (*Textfigure 31*).

One male in the collection of W. H. Twenhofel of the University of Kansas.



FIGURE 31.—*Tethneus twenhofeli* n. sp. $\times 3.33$.

The specimen is fairly well preserved and presents the dorsal surface with coxæ and chelicerae impressed on the carapace. Pedipalpi and legs are complete except for those of the fourth pair one of which is broken off across the tibia and the other across the metatarsus. The spider has a close resemblance to some recent *Epcira*, but I placed it under *Tethneus* on account

of the greater size of its first and second femora as compared with those of the third and fourth leg. The abdomen is broken off near its tip and the total length of the spider may be therefore given only approximately as 7.8 mm. The carapace is longer than wide, narrower in front, widest in posterior third, with a distinct longitudinal groove. The eyes are indiscernible. An interesting feature of the two anterior pairs of legs is the considerable difference in the diameter of the end of the tibia and the base of the metatarsus. There can be no doubt that the fourth leg was longer than the third and the legs are therefore in order 1243.

Measurements of legs: First leg, femur—4 mm., tibia with patella—4 mm., metatarsus with tarsus—5 mm., total 13 mm. Second leg, femur 3.4 mm., tibia with patella—3.8 mm., metatarsus with tarsus—3.8 mm., total—11 mm. Third leg—femur—2.5 mm., tibia with patella—2.5 mm., metatarsus with tarsus—2.5 mm., total—7.5 mm. Fourth leg, femur—2.6 mm., tibia with patella—2.5 mm.

There are numerous heavy spines on all legs, and legs and body are clothed with short, simple, brown hair.

The pedipalpi show a large copulatory apparatus the details of which cannot be made out but the outward appearance of which reminds that of recent Epeiridæ.

***Tethneus robustus* n. sp. (Textfigure 32).**

One male from Florissant, No. 16412 (119) in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

The specimen presents the dorsal surface, shows the characteristic difference in the size of the femora, but is on the whole rather poorly preserved.

Total length 6 mm. Carapace oval, slightly narrower in front than behind, 2.4 mm., long, 1.8 mm. wide. The four median eyes alone are preserved. They are round, equal in size and the quadrangle is almost square. Legs in order 1243, those of the first and second pair much heavier and provided with numerous spines. There is also simple brown hair on body and legs. The pedipalpi are rather unusually well preserved although the details naturally cannot be made out. Nevertheless one may discern in the right

copulatory apparatus a deeply forked organ which probably represents both the embolus and conductor.



FIGURE 32.—*Tethneus robustus* n. sp. Specimen No. 16412 (119). $\times 5$.

Measurements of legs: First leg, femur—2.7 mm., tibia with patella—3.2 mm., metatarsus with tarsus—3.9 mm., total 9.8 mm. Second leg, femur—2.5 mm., tibia with patella—2.7 mm., metatarsus with tarsus—3.1 mm., total—8.3 mm. Third leg, femur—1.4 mm., tibia with patella—1.6 mm., metatarsus with tarsus—2.0 mm., total—5.0 mm. Fourth leg, total—7.0 mm.

Genus *Epcira* Walckenaer.

Scudder has described six distinct species from Florissant and I have added two new species. All these species are undoubtedly close to recent spiders grouped under the cohors *Araneus* which notwithstanding the splendid efforts of the late Frederick P.

Cambridge still defies the ingenuity of arachnologists who want to split it into a series of genera.

Epcira mcekei Scudder.

Scudder, Tertiary Insects, 1890, p. 83, Plate II, figs. 2 (♀),
17 (♂).

Two males, Nos. 9211 (now No. 104) and 8221, and one female No. 3204 (now No. 105) in the Scudder Collection of the Museum of Comparative Zoology of Harvard University. Scudder's description is correct.

Epcira abscondita Scudder.

Scudder, Tertiary Insects, 1890, p. 84, Plate II, fig. 7 (♂).

One male from Florissant, No. 7583 (now No. 106) in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

Scudder's description is correct, but his measurements are incomplete. I have exposed all legs which are in order 1243. First leg, femur—2.8 mm., tibia with patella—3.4 mm., metatarsus with tarsus—4.3 mm., total—10.5 mm.; Second leg, femur—2.9 mm., tibia with patella—3.0 mm., metatarsus with tarsus—4.3 mm., total—10.2 mm.; Third leg, femur—2.6 mm., tibia with patella—1.8 mm., metatarsus with tarsus—2.3 mm., total—6.7 mm.; Fourth leg, femur—3.4 mm., tibia with patella—2.3 mm., metatarsus with tarsus (broken off very near its distal end)—3.1 mm., total—8.8 mm.

Epcira delita Scudder.

Scudder, Tertiary Insects, 1890, p. 85, Plate II, fig. 6 (♂?).

One specimen from Florissant, No. 13523 (now No. 107) in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

Scudder's description is correct. The pedipalpi are absent, but the shape of the body and the proportion of the legs leave little doubt as to the sex of the specimen.

Epeira cinefacta Scudder.

Scudder, Tertiary Insects, 1890, p. 85, Plate 11, fig. 16 (♂).

One male from Florissant, Nos. 8576 (now No. 108) and 8806 (now No. 109).

Scudder's description is correct. The appearance of the specimen reminds one rather of recent *Mangora* than *Epeira*.

Epeira vulcanalis Scudder (*Textfigure 33*).

Scudder, Tertiary Insects, 1890, p. 86.

One male from Florissant, No. 5784 (now No. 110) in the Collection of the Museum of Comparative Zoology of Harvard University.



FIGURE 33.—*Epeira vulcanalis* Scudder. Specimen No. 5784 (110). $\times 5$.

Scudder's description is correct. As he omitted to give a figure of the spider it seemed to be advisable to give one now. It may be added that the spinnerets appear as a dark brown disc a little in advance of the posterior end of the abdomen. An interesting feature is the dark line surrounding the disc and reminding one of the circular wall around the spinnerets in recent *Gasteracantha*.

Epeira emertoni Scudder.

Scudder Tertiary Insects 1890, p. 87, Plate 11, figs. 15 (♂),
19 (♀).

One male, No. 8777 (now No. 111) and two females, Nos. 10998 (now No. 112) and 5117. The latter I have not seen. Specimens in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

Scudder's description is correct. I am not able to decide whether the specimens represent a male and a female of the same species.

Epeira longimana n. sp. (*Textfigure 34*).

One rather poorly preserved male from Florissant, No. 16378 (now No. 123) in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

The specimen is complete except for a small fraction of one chelicera and of the side of the abdomen. Total length—7.3 mm., Abdomen—4 mm. long, 3 mm. wide in its anterior third. It is typical of the shape of recent species of *Epeira*. The palpi are not clearly discernible, nor can the separation line between the carapace and chelicerae be demonstrated. Although the spider represents the ventral aspect, the sternum is not discernible, nor is there any trace of the edge of the carapace. The shape of the abdomen is as represented in our figure, but at first glance one sees only the darker area. It is the presence of brown hair on the abdomen, which helps to establish the true outline of the latter. There is similar hair on the legs, together with some distinct spines. The legs are in order 1243. The characteristic feature of this species is the proportion in the length of the tibiae of the first and second leg. As shown by the measurements these tibiae are considerably shorter than the corresponding femora, a condition unusual in *Epeira* and possibly of a generic value.

Measurements of legs: First leg, femur—5.2 mm., tibia with patella—3.8 mm., metatarsus with tarsus—6.0 mm., total—15.0 mm.; Second leg, femur—3.8 mm., tibia with patella—2.8 mm., metatarsus with tarsus—4.2 mm., total—10.8 mm.; Third leg, femur—1.8 mm., tibia with patella—1.7 mm., metatarsus with tarsus—1.8 mm., total—5.3 mm.; Fourth leg, femur—2.7 mm.,



FIGURE 34.—*Epeira longimana* n. sp. Specimen No. 16378 (123). $\times 5$.

tibia with patella—3.0 mm., metatarsus with tarsus—2.8 mm., total—8.5 mm.

Nothing else can be made out.

***Epeira indistincta* n. sp. (Testfigure 35).**

One male from Florissant, No. 14986 (now No. 122) in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

There seems to be little doubt as to the sex of this specimen, although the shape and size of the abdomen is rather unusual and more typical of recent females. Yet one can see two dark impressions in front of the sternum, having more the appearance of the palpal bulbs than of chelicerae. The spider presents its ventral



FIGURE 35.—*Epcira indistincta* n. sp. Specimen No. 14986 (122). x 5.

surface and is very poorly preserved. It is the faintness of the outline of its abdomen, which induced me to give to this species the name *indistincta*. At first one sees only the darker area behind the hind femora and the spinnerets. On careful examination however one notices the true shape especially since the abdomen is clothed with very short brown hair which is more or less plainly discernible under higher power.

Total length 5.7 mm. The legs are very incompletely preserved and cannot be measured satisfactorily. It is evident, however,

that their order is 1243. The first femur is heavy, the fourth longer than the first, but considerably more slender. The third femur is quite short. The legs of the third pair are bent across the abdomen. All legs are thickly covered with short hair, but there are only a few spines discernible. The spinnerets appear as a dark disc considerably in front of the posterior end of the abdomen and seem to be circumvallated as in the preceding species.

Epeira sp.

Scudder, Tertiary Insects p. 88. Plate 11, fig. 1.

An incompletely preserved specimen No. 9285 (now No. 113) from Florissant in the Collection of the Museum of Comparative Zoology of Harvard University. All that can be made out has been described by Scudder. The generic affiliation is very uncertain.

Epeira sp.

Scudder, Tertiary Insects, 1890, p. 89.

Scudder mentions this specimen, No. 63 from Green River, Wyoming. I have not seen it, but the few words which Scudder uses for its characterization are sufficient to show that the specimen is too poorly preserved to be of any value.

FAMILY LYCOSIDÆ.

Characters of the Family:—Eight eyes in three rows, all diurnal. First row composed of four small eyes. Eyes of the second row largest, directed forward, those of the third row directed upward. Posterior piece of the lorum of the petiolus emarginate in front. Trochanters notched. Claws 3.

Genus *Lycosa* Latreille.

At present the genus *Lycosa* is used by one group of Arachnologists with Simon as their spokesman for species referred by the other group to the genus *Tarentula* which two genera are therefore synonymous. On the other hand the second group uses the name *Lycosa* for spiders which Simon places under the genus *Pardosa* C. Koch. I am accustomed to follow Simon's definition.

The only spider which I refer to the genus *Lycosa* has the external appearance of recent representatives of the genus. This is, however, as far as one can go in placing the spider and in this paper I use therefore the genus *Lycosa* in an indeterminate sense.

Lycosa florissanti n. sp. (Textfigure 36).

One female, Nos. 10234 and 10240 in the Collection of the American Museum of Natural History.



FIGURE 36.—*Lycosa florissanti* n. sp. Specimen No. 10234. $\times 3.33$.

Except for the ends of the first and second pair of legs the specimen is complete and is well preserved. Total length including chelicerae—8.0 mm. The carapace is three mm. long, oval in shape, slightly narrowed in front. The eyes are not discernible. The abdomen is elliptic, evenly rounded in front and in the rear, 4 mm., long, 3 mm. wide. The chelicerae are powerful. On the reverse one can clearly see their entire outline, the sternum and the coxae, the posterior pair of which is contiguous. The spinnerets are visible but the details cannot be made out. The epigynum can also be seen and reminds one of the similar organ in recent

species, although no detail is discernible. The third and fourth right trochanters show a notch at their distal ends. Body and legs are thickly clothed with simple brown hair. A few spines can be seen on the legs and palpi, but their arrangement cannot be determined. Measurements of legs:—First leg, femur—2.8 mm., tibia with patella—3.6 mm.; Second leg, femur 3.0 mm., tibia with patella—3.3 mm.; Third leg, femur—2.8 mm., tibia with patella—2.8 mm., metatarsus with tarsus—3.2 mm., total—8.8 mm.; Fourth leg, femur—3.0 mm., tibia with patella—3.7 mm., metatarsus with tarsus—4.0 mm., total—10.7 mm. From these measurements it would appear that the fourth leg is in all probability the longest. The femora are heavy, those of the first and second pair appreciably distended in the middle. The pedipalpi are slender, 3.0 mm. long. No claws can be seen, nor can anything more be exposed.

ORDER OPILIONES.

Characters of the order:—Abdomen segmented, broadly joined to the cephalothorax. Chelicerae three-jointed, chelate. Pedipalpi not chelate. Coxae of pedipalpi and of the first and second pair of legs with maxillary lobes (gnathobases). Tarsi of variable number of joints. Eyes two. Respiration by means of tracheal tubes with one pair (sometimes with two pairs) of stigmata.

The separation of the order into sub-orders is based on the relative position of the coxae.

Genus *Phalangium* Linnaeus.

This genus belongs to the sub-order Plagiostethi of Simon, or Palpatores of Thorell. Nevertheless I am using it here in an indeterminate sense, merely as representative of the order or at best of the sub-order.

Phalangium oculatum n. sp. (*Textfigure 37*).

One specimen, No. 9494 (now No. 121) in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

Total length—3.8 mm. Abdomen 2.4 mm. wide, with a darker band in the middle and two short, pointed spines near the poste-

rior end. Two circular eyes, separated from each other by their diameter, are situated on a transversely oval field. This field is quite flat and it is not probable that in life it had the shape of a tubercle. The chelicerae are scarcely visible. The pedipalpi are

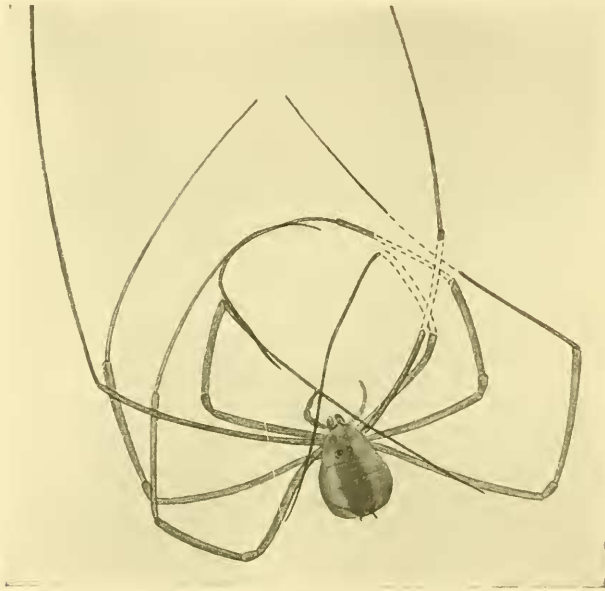


FIGURE 37.—*Phalangium oculatum* n. sp. Specimen No. 9494 (121). $\times 3.33$.

short. The legs are very long. Those of the second pair are broken off and even in the left leg, which is more complete than the corresponding right leg, it is not possible to determine how much of the leg is missing. The right first leg is complete except for the tibia, the right third leg complete except for a piece of the metatarsus and the right fourth leg complete except for a short piece on each side of the tarso-metatarsal joint. The legs of the left side are complete except for the end of the second leg. Measurements are difficult owing to the curvature of the joints and are therefore only approximate. First leg, femur—4.7 mm., tibia with patella—4.6 mm., metatarsus with tarsus—12.6 mm., total—21.9 mm.; Second leg, femur 8.0 mm., tibia with metatarsus and tarsus (incomplete)—17.0 mm., total (incomplete) 25.0 mm.;



FIGURE 38.—*Phalangium lacoci* n. sp. Specimen No. 38124. x 2.5.

Third leg, femur—5.8 mm., tibia with patella—5.7 mm., metatarsus with tarsus—8.4 mm., total—19.9.; Fourth leg, femur—6.8 mm., tibia with patella—6.0 mm., metatarsus with tarsus—16.5 mm., total—29.3 mm.

It is not possible to determine the sex of the specimen.

Phalangium lacoeci n. sp. (*Textfigure 38*).

One specimen No. 38124 in the R. D. Lacoec Collection of the U. S. National Museum.

This is a considerably larger species than the preceding one and reminds one greatly of the common recent species of *Liobunum*. The dorsal surface alone is visible, but no traces of segmentation can be made out. Neither are the eyes discernible. A broad median longitudinal band extends from the anterior to the posterior end of the body. The body is clothed with scattered short stout hair. The fourth legs and the left third leg are complete. The others are broken off as represented in our figure. The right second leg is misplaced in such a way that it comes to lie between the third and fourth legs, the former being directed forward. It may be recognized however by its heavier femora. Total size—6 mm., width in middle 4 mm.

First leg, femur—4.0 mm., tibia with patella—5.5 mm.; Second leg, femur—6.8.; Third leg, femur—8.3 mm., remaining joints—16.2 mm., total—24.5 mm.; Fourth leg, femur—8.0 mm., remaining joints—24.0 mm., total 32.0 mm.

The sex cannot be determined and nothing else can be made out.

APPENDIX.

LEGS OF UNCERTAIN ARACHNIDS.

Scudder has described five legs representing five separate specimens, Nos. 3, 4a, 36, 4199 and 4200. He considered these fragments as belonging to some species of the genus *Epeira*. I have not seen his specimens 4a and 36. Of the other specimens No. 4199 (now No. 115) in the Collection of the Museum of Comparative Zoology of Harvard University is excellently preserved and is reproduced in our *textfigure 39*. The coxa and trochanter are missing. The femur is 6.4 mm. long with two rows of spines of about 12 spines in each row. The average length of these spines

is about 0.5 mm. The patella is exceedingly short. The tibia together with the patella is 7.5 mm. long. There are two rows of about fourteen spines each on the tibia. These spines are longer than those on the femur, the third spine from the base

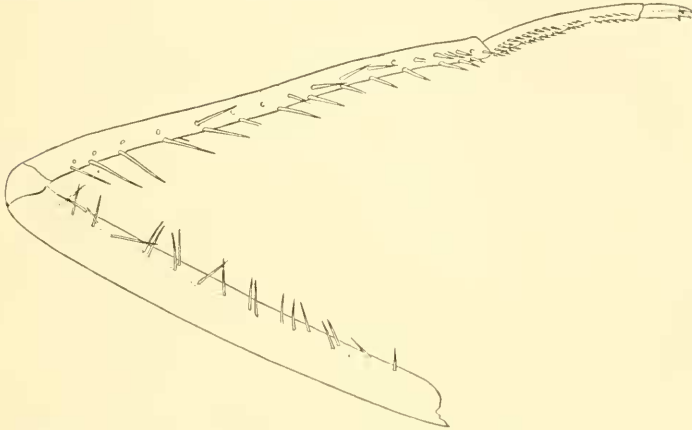


FIGURE 30.—Leg of an Arachnid. Specimen No. 4199 (115). $\times 10$.

measuring 1.0 mm. Several spines of one of the rows are missing, but their bases of attachment are clearly discernible. The metatarsus is slightly curved 2.3 mm. long with two rows of about 20 spines each, the spines being very short. The tarsus is only 0.7 mm. long, without spines but with two terminal claws. Each claw is smooth, but with a basal, short, conical tooth. There is no trace of hair on the leg.

The leg is plainly not that of an *Epeira*, nor do I know of any spider with an arrangement of spines similar to this, for these spines are distinctly limited to the ventral surface. The other two specimens, now Nos. 114 and 116, are not complete, but apparently belong to the same species.

COCOONS OF SPIDERS.

Scudder has described and figured cocoons of spiders, referred by him to the species *Aranca columbiac*. (Tertiary Insects, 1890, p. 71, Plate 2, figs. 1 and 2.) I have not seen his specimens, but judging from his description and figures one would suspect that the cocoons in question belong to more than one species. It would of course be impossible to determine the species.